

A Short report on the

Feeders, Milk Supply
and Land Utilization

problems of the

Madras State.

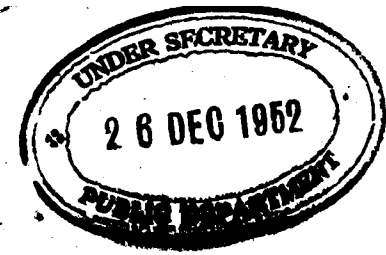
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**A SHORT REPORT ON THE
FODDER, MILK SUPPLY AND LAND
UTILIZATION PROBLEMS OF THE
STATE OF MADRAS**

BY

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A SHORT REPORT ON THE FODDER, MILK SUPPLY AND LAND UTILIZATION PROBLEMS OF THE STATE OF MADRAS.

CHAPTER I.

NATURE AND MAGNITUDE OF THE FODDER PROBLEM.

1. *Introduction.*—The Government of Madras have been spending large sums of money to tide over the periodical fodder scarcities which occur, rather too frequently in the State, especially in the Ceded districts. The concerned Heads of Departments have suggested the adoption of various measures to solve the problem in the State in general and the Ceded districts in particular. The Board of Revenue has suggested the setting up of a State-wide animal foodstuff organization for dealing with all aspects of the problem. Another suggestion made was that it might be preferable to set up a permanent expert committee called a Milk Board, which may perform the duties of the Provincial Fodder and Grazing Committee and the proposed Provincial Land Utilization Board and also examine the question of increasing the productivity of land, elimination of fodder scarcity and all aspects of milk production and distribution, etc. The Government considered that before such a Board was constituted, two officers of the Forest and Agricultural departments may be appointed to examine all the materials regarding fodder production and make constructive suggestions for the consideration of the Government. In accordance with this decision, the Board of Revenue (Civil Supplies) submitted in consultation with the Director of Agriculture and the Chief Conservator of Forests, proposals for the appointment of two officers, with necessary subordinate staff, for taking up the investigation. The Government approved the proposals and sanctioned, in their Order Ms. No. 112, Development (P. & D.), dated the 8th January 1948, the employment for a period of three months of a forest officer and an agricultural officer, from the research section, with a subordinate staff consisting of one lower division clerk and five peons. Madras was fixed as the headquarters of this staff and they were to be attached to the office of the Chief Conservator of Forests. The Director of Agriculture considered that the best period to commence the investigation was from 1st October 1948 and this suggestion was approved by the Government.

2. *Preliminary work.*—We entered on our special duty on 10th November 1948 at the office of the Chief Conservator of Forests, Madras. A preliminary note mentioning the scope and nature of the investigation proposed to be done was submitted by us on 23rd November 1948 for orders. The note was discussed with us by the Chief Conservator of Forests and the Director of Agriculture on 3rd December 1948.

3. *Extension of special duty.*—It soon became clear that the investigation would not be over within the three months originally sanctioned and that at least two more months would be necessary. The Government in their Order, Ms. No. 441, Development (P. & D.), dated 28th January 1949, sanctioned the extension of the special duty by two months.

4. *Places visited.*—We commenced our touring on 8th December 1948 and we were practically on a continuous tour till about the middle of March 1949. (Sri T. Venkataramana Reddi was out on tour till 22nd March 1949.) We camped at the following places:—

Mangadu, Tirupati, Madanapalle, Bangalore, Hosur, Mettur, Satyamangalam, Coimbatore, Palayankottai, Tada, Rapur, Guntur, Rajahmundry, Waltair, Bapatla, Chittoor, Cuddapah, Chelama, Diguvametta, Kurnool, Hagari, Siruguppa, Bellary, Anantapur, Tindivanam, Aduthurai, Pattukkottai, Tiruchirappalli, Madurai, Palghat and Kozhikode. In addition, Sri T. Venkataramana Reddi, visited Valparai and Vellore. In our camps we met the concerned District Officers, had discussions with them and visited Dairy and Livestock Farms and the Agricultural Research Stations. We also discussed the problems with the ryots to understand their local difficulties regarding fodder.

5. *Questionnaire.*—In the course of our investigation, a questionnaire was prepared and sent to all the Collectors of the State, Deputy Directors of Agriculture and Conservators of Forests. A few have sent their replies, but many more are yet to send them. Some have no suggestions to make, while one has written that he has neither the time nor the staff necessary for furnishing the information. A copy of the questionnaire is Appendix I.

6. *Cattle population.*—According to the latest census held in December 1944, the total bovine population of the State was 22,644,239, as given below:—

Cows and bulls.

Males—

Number of breeding bulls kept for breeding purposes only	91,144
Working bullocks (over three years)	5,648,336
Breeding and working males	842,310
Non-working bulls and bullocks	360,759
Total, males	6,942,549

Females—

In milk	1,864,058
Dry cows	2,155,862
Not calved	1,009,593
Cows used for work only	584,540
Cows non-working or non-breeding	193,026
Total, females	5,807,079
Young stock, males and females	3,605,286
Grand total	16,354,914

Buffaloes—

Breeding bulls	52,008
Working bullocks	1,010,638
Bulls and bullocks, non-working	1,16,729

Total, males ... 1,179,375

She-buffaloes in milk	1,569,658
Dry buffaloes	926,120
Not calved	423,836
Buffaloes used for working	77,160
She-buffaloes over three years not in use for work or breeding purposes	46,053

3,042,827

Young stock, males and females ... 2,067,123

Total, buffaloes ... 6,289,325

Total, bovine stock ... 22,644,239

7. *Bovine stock in the past.*—Past census figures of the bovine population are given below:—

Year.	Number of cattle and buffaloes.	Year.	Number of cattle and buffaloes.
1899-1900	15,057,180	1924-25	21,824,695
1904-05	16,690,261	1929-30	22,430,730
1909-10	21,089,397	1934-35	24,607,820
1914-15	21,750,583	1939-40	22,119,402
1919-20	21,894,328	1944-45	22,664,239

From the figures it will be seen that the very small variation in the bovine stock over the last thirty-five years cannot be accounted for in a rational manner. Some doubt has also been thrown on the accuracy of these cattle census figures, because all-India figures have registered a progressive increase as the following table will show:—

	1912-13.	1926-27	1934-35.
		(in millions).	
Cattle and buffaloes	152.8	187	214.2

The major portion of the increase in bovine population between 1912-13 and 1934-35, an increase of 45 per cent in two decades, comes from small cultivators in the zones of human concentration, where the majority of holdings are uneconomic. Madras comes under this category. It has also been suggested that the death-rate of cattle keeps pace with the birth-rate, as the heifers and he-buffaloe calves are neglected and large numbers of them die.

8. *Cattle population and area under crops.*—In the year 1944-45, in Madras State 31,533,828 acres were under cropping, while the bovine population then was 22,664,239. This works out

to 75 animals for every 100 acres cropped. This figure may be compared with similar figures for other Indian States and other countries.

Number of cattle kept for every 100 acres of cultivated area—

Bengal	108	Holland	38
Bihar and Orissa	89	Egypt	25
United Provinces	91	China	15
Madras	75	Japan	6
India	* 67		

* (Inclusive Pakistan.)

Compared with Egypt and China, where intensive cultivation is practised, Madras maintains a very large number of animals. In spite of this large stock, the work cattle are still in short supply as the following figures collected by the Provincial Marketing Officer will show :—

	1944-48.
Animals available	8,163,000
Animals required for cultivation in villages ...	7,860,000
Used for carting in urban areas	400,000
Used as pack animals	8,000
Used in oil crushing industry	62,000
Total required	8,330,000

9. *Analysis of census figures relating to cows.*—According to the figures given earlier the total number of cows in milk is 1,864,058 and that of dry cows is 2,155,862. Cows over three years, used only for work, come to 584,510. Taking also into consideration "other cows over three years numbering 193,026 which do not do either work or breed", out of a total cow population of 5,807,079, only 1,864,058 are under milk. Even these milkers yield on the average only 410 lb. per cow per annum as against 1,445 lb., 1,315 lb. and 1,000 lb. yielded by cows in Punjab, Sind and Western India States respectively. These figures reveal that our cow is not looked after properly. Our enquiries also confirm this fact. They are very badly undernourished and, in consequence, they are irregular breeders. The average period between two successive calvings runs in the villages even up to four years. The cows also do not get served at the proper time. On account of undernourishment, the average age of first conception among the village cows is about the fifth year, whereas well looked-after cows are ready to calve in their third year. Further, the dry period of cows under proper management rarely exceeds four months. From these facts, it will be clear that an unnecessarily large stock of cows is maintained for obtaining (1) milk and (2) the necessary number of bulls and bullocks. Under proper management and correct feeding, there may not be any necessity to carry such a large stock. It is well known that the she-buffalo is a well looked-after animal. It gets a satisfactory feed and it breeds more or less

regularly. This fact is borne out by the census figures. As against 1,569,658 she-buffaloes in milk, the dry buffaloes are only 926,120, just 60 per cent of the animals in milk whereas in the case of cows, the dry cows are 116.9 per cent of the cows in milk.

10. *Views about our excessive cattle population and remedies suggested for reducing their number.*—Lack of sufficient pastures, absence of good fodder and the inability of ryots to stall-feed their animals are responsible for the rapid deterioration of our cattle. As the cattle have become less efficient, their number has to be increased. The amount of food needed in proportion to their size increases. All this accelerates the rate at which the conditions become worse both for breeding and maintenance of good stock. A smaller number, *fed properly*, will be able to give all the milk required and do all the work which has to be done, and yield an adequate number of better calves. Then there may not be any need to keep such a large stock and more fodder will become available. How best to achieve this is the problem? The popular view is that the numbers of cattle have become so large and their efficiency has fallen so low that the task of reducing the number of useless animals and of reversing the course of deterioration will now be extremely difficult. It is also held that the Hindu sentiment, against the killing of a cow or bullock, aggravates this malady. Unless this sentiment is abjured altogether, many animals, which are quite useless from birth to death, will continue to infest our countryside. When the animals are all herded together, promiscuous breeding by half-starved scrub males cannot be prevented. As a result, the quality of cattle deteriorates still further. The remedy suggested by the different commissions and leading economists is to reduce the number of our cattle ruthlessly by slaughtering them. A change in our dietary habit has also been suggested. A leading economist, Mr. Radha Kamal Mukerjee, has even held, that so long as the present attitude towards the maintenance of uneconomical and useless cattle remains, it will be folly to increase the total output of fodder. The theory is that if more fodder is produced more hungry cattle will be born and there will be no solution to the problem of malnutrition and over-population.

11. *Necessity for modifying the popular view.*—The popular view mentioned in the previous paragraph may have to be altered in the light of the following facts. Granting that the Hindu is a sentimental person hide-bound by tradition and custom and that he will not either directly or indirectly countenance the slaughter of cows and bulls, what about Bengal which is predominantly Muslim in population in its eastern districts? In Bengal, 108 animals are maintained for every 100 acres of cultivated area, as against only 75 in Madras. There are groups of villages inhabited exclusively by Muslim cultivators, who have no religious objection to slaughter of cows and bulls and yet their cattle do not appear to be better fed. If their cattle had been in good condition, they would not have the necessity of maintaining such a high number

our investigations. The memoir gives a list of 19 taluks, the reports from which required further scrutiny, before they were finally accepted. The figures of Bellary, North Arcot and Madurai districts are also questionable as the same yields have been assumed for all the taluks of each of these districts though the conditions in them are not homogeneous. The memoir gives only the total quantity of available fodder and not fodder and grazing actually utilized.

17. *Division of State into categories and the daily fodder ration available in them.*—The whole State has been divided into five categories: scarce, deficient, satisfactory, surplus and abundant, depending on the availability of fodder. Actual fodder available in each category is given below—

Category.	Available ration per day. LB.
I (Scarce)	2.76
II (Deficient)	3.76
III (Satisfactory)	5.19
IV (Surplus)	6.66
V (Abundant)	11.27

The average for the whole Province works out to 4.91 lb. per day.

18. *Statistics of fodder production, etc., for the State.*—The following details have been taken from the memoir and this will give an idea for each category of the total quantity of fodder and grass produced, the area, and the human and animal population:—

Category.	Area in thousand- acre units.	Human popu- lation in thousands.	Animal population in thousand- cow units.	Total quanti- ties of fodder produced in thousand- ton units.
I	15,211	9,124	5,803	3,620
II	26,938	16,613	11,764	9,184
III	22,989	16,147	10,094	11,064
IV	7,523	3,939	2,635	3,485
V	7,839	4,783	2,923	6,399
Province ..	80,498	60,606	33,219	33,752 *

* Includes grass produced in forests as well.

Assuming that the figures given in the memoir are reasonably accurate, even for providing a ration of 6-2/3 lb. of dry roughage per day, which is considered to be a satisfactory maintenance ration in the memoir, the deficit is 1.76 lb. per day per cow unit. According to the Animal Husbandry department, a healthy animal requires at least 2 lb. of dry roughage for every 100 lb. of its live weight. This will mean that a 500 lb. animal, a cow unit, will

require at least 10 lb. of roughage per day as against the available ration of 4.91 lb. per cow unit. In other words, the target must be to double our fodder production, if the existing animals have to be fed adequately. As fodder is a bulky commodity which is extremely expensive to transport to the actual deficit areas, it has to be produced in the area itself. While taking steps to achieve this, the qualitative aspect of the different fodders should also be examined and deficiencies in the intake of protein, minerals, salts and vitamins should be carefully investigated.

19. *Consideration of the Memoir by the Madras Fodder and Grazing Committee.*—At a special meeting convened for the purpose, the Madras Fodder and Grazing Committee considered the "Memoir." The Committee was prepared to abide by the view, that 20 lb. of green roughage per day or 6-2/3 lb. of dry roughage, will suffice as a maintenance ration for the average cow unit of the State weighing 500 lb. But the Committee was not satisfied, that either the average live weight of cattle or the minimum maintenance ration can be finally determined on the information now available. The Committee considered that in future studies a goat or sheep should be reckoned at one-third of a cow unit and a buffalo at 1½ cow units and that the old conversion factors of 2 sheep—1 cow—half buffalo did not agree with observations. The Committee accepted the information given in section 6 of the memoir as a close enough indication of the magnitude, and the location of the deficits. The most important finding of the Committee is given below:—

"The Committee considers that it is time to design and inaugurate a definite policy to improve the feeding of cattle in the Province. It considers that the steps suggested in the memoir should be undertaken and that action should not wait until they are complete. It observes that the problem, as it presents itself in the light of the memoir is one of ecology, requiring a balanced use of the land which takes full account of the natural conditions and the requirements of the animal population. The problem is therefore not one for a committee like the Fodder and Grazing Committee dealing with particular aspects of land use, but one to be tackled by a Land Utilization Board, working both through the existing departments and through a department of soil and water conservation. The Committee repeats this recommendation for the early formation of a Land Utilization Board and suggests that the Board should supervise the reclamation, development and conservation of land and water resources and that it should take pains to ensure that in every project, the needs of the animal population are given a proper weight. It should see that when the land is reclaimed, irrigated and colonized, the cultivation of fodder is promoted to the extent required, by a plan of balanced development. Pending the institution of a Land Utilization Board, all departments dealing with irrigation and other projects should be urged to make special provision for fodder cultivation."

20. *All-India figures relating to cattle fodder deficiency.*—In the minutes of the fourth meeting of the Animal Husbandry Wing of the Indian Council of Agricultural Research, the following information was available :—

Foodstuffs available per head of cattle in India.

	Available in India in tons.	Available per animal per day for 214 million head of cattle.	Normal require- ments for an animal 500 lb. body weight.
		LB.	LB.
Total digestible nutrients ..	6,10,13,000	1.456	3.9
Total digestible crude protein.	27,63,000	0.079	0.2
Dry matter—			
Dry fodder	11,10,00,000	3.17	} 10.11
Green fodder	1,90,00,000	0.55	
Concentrates	38,00,000	0.11	

This information shows that even in other parts of India, the fodder deficiency is acute.

21. *Concentrates.*—To make up the protein deficiency in the cattle feed and in order to balance the rations, cattle require some supplementary concentrated feed in addition to the roughages to maintain themselves in good condition. According to the Fodder and Grazing Committee's Memoir, the total production of concentrated feeds is estimated at 1,918,000 tons. This allows a per capita consumption of $\frac{1}{2}$ lb. per day. A minimum ration is placed at $\frac{3}{4}$ lb. per day per capita. Luckily, this State has the largest area under groundnut and with the development of the oil-milling industry if all the groundnut produced is crushed here alone, it will result in the production of 6 lakhs tons of cake, which will become available for feeding cattle and for manuring crops. As the export of groundnut cake is restricted, all available supplies can be conserved. Also an improvement in the production of cereals will result in the increased production of bran, which are used as concentrates.

22. *Position regarding the production of oil-cakes in the State.*—It is roughly estimated that nearly 240,000 tons of groundnut cake are received through the expellers and rotaries while another 162,000 tons are produced through the 'Ghanis.' It may be assumed that the latter quantity is used primarily for feeding cattle. The cake produced by expellers is mostly utilized as manure.

The figures of exports and imports of groundnut cake into our State for the three years ending 1947-48 are given below :—

Year.	Exports.	Imports to Madras and Southern Mahratta Railway stations only.	
1945-46 ..	Restricted ..	13,764	} Imports mainly from Hyderabad.
1946-47 ..	Do. ..	4,440	
1947-48 ..	Do. ..	13,162	

The imported cake may be assumed to be used mainly as manure.

About 60,000 tons of gingelly cake are produced annually, in this State and this is largely used for feeding cattle. In this connexion, it is strongly recommended that export of groundnut outside the country in the form of kernels should be totally prohibited and export should be only in the form of oil in order to conserve all the available cake both for cattle feed and manure in this country.

CHAPTER II.

CAUSES OF PRESENT FODDER SCARCITY.

23. *Introduction.*—The steady deterioration of grazing in the reserved forests and the increasing scarcity of fodder in areas outside them have to be considered separately because the reserved forests are owned by the State and administered directly by it under the Madras Forest Act V of 1882, whereas the other lands are owned privately by numerous owners.

24. *Grazing in reserved forests, past and present.*—Even in the olden days grazing was by no means free especially in the best grazing districts. The Krishna District Manual records that the old rajas and zamindars were in the habit of giving grazing leases of hill and jungle areas to their favourites who collected the maximum grazing fees possible. This practice continued until 1886 under the British Government also subject to the leases being sold, instead of being gifted. In 1886, the Government prescribed the maximum fees to be levied by lessees. A Government record of the year 1894 reveals that, under the old system, the grazing fees varied from Re. 1 to Rs. 7-8-0 per head the prevailing rate being Rs. 3. In 1856, the Government limited the collection of grazing fees to hills and large stretches of jungles only. This meant that prior to that year, the grazing fees were collected on cattle grazing even on village porambokes and waste land. In 1859, the Revenue Survey department allotted to each village, wherever possible, an area of waste land known as 'Dharma khandam' or free grazing ground, equivalent to 30 per cent of the area under cultivation. It is also on record that even when they paid the grazing tax, the villagers were permitted to graze their cattle only within the limits of their village. In 1890, the Government examined various questions including pasturage and fodder and laid down that the object of Forest legislation was not merely to obtain power to deal more effectively with timber-producing forests, but also to improve the sources of fodder grass and that with this objective, powers were taken to regulate the rights and privileges which the villagers possessed over the waste lands. The Committee which drafted the Forest Act has recorded

that as a result of these measures, the forests will, in course of time, furnish an abundant supply of wood and cattle fodder. They also advocated the retention of the large extents of waste land, with a view to securing a larger and more certain supply of pasture, chiefly during seasons of drought. The Indian Famine Commission wrote nearly 60 years ago "We have evidence from all parts of India, that the mischievous practice of indefinite trespass on the public forests has sprung up from shortsighted eagerness for immediate profit; . . . the public interest requires that any reasonable privilege of this kind, which it would be harsh to abolish, should be enjoyed only within definite limits and under salutary rules. Village communities may thus be brought to avail themselves of forest produce in a manner consistent with its re-production and not with a licence recklessly destructive of the public property." From 1882 onwards attempts were made to constitute village forests to be managed by villagers as a 'fuel and fodder reserve' and in 1885, the Collectors were directed to set apart areas that would meet the reasonable demands of the local people. The produce from such lands should not be sold or bartered. But this idea of village forests was subsequently abandoned on the grounds, that it would be impossible to supervise effectively large numbers of small blocks. Instead, big blocks of reserved forests were constituted, to be managed by Government, to provide the local requirements of forest produce and grazing, for all the cattle necessary for agricultural and domestic purposes. The Government laid down that surplus animals should be allowed grazing only when circumstances permitted it. Otherwise they said the result of protection will only mean a large increase in the number of animals requiring pasture and failure of all efforts to improve the grazing grounds. The surplus animals were to graze in unoccupied unreserved land, of which there was considerable area in every village. They also wanted to limit the number of cattle to be admitted inside the reserved forests. There were practical difficulties in working out the system of privileged and non-privileged cattle, especially as the privileged cattle were to be licensed at half rates. This distinction was however abolished in 1895 and a uniform grazing rate was introduced. Along with this measure, grazing blocks and compartments were also formed, but it was considered impossible to restrict the grazing to the carrying capacity of the forests. In the meanwhile, in most districts, the block system of grazing had been introduced, the grazing permit being tenable only in the block for which it was issued. Several schemes were suggested restricting the number of animals, to the grazing capacity of the area and among these, the Krishna Grazing Scheme deserves special mention. According to this scheme, the grazing areas were divided into compartments so as to equalize the grazing areas, for which separate grazing fees should be paid. To collect the grazing revenue, the permit-issuing officers were to be replaced by foresters. The introduction of half-yearly, as well as yearly permits, the improvement of

grazing grounds by rotational closures, regulation of the number of cattle admitted to each compartment, manuring and seeding where necessary, limiting different classes of cattle to different areas and finally the segregation of diseased from healthy cattle and keeping special areas for the eased animals, were the additional noteworthy features of the scheme. This 'Parcelle' or compartment system was accepted by the Board of Revenue with certain modifications. This scheme it must be conceded is a good scheme, as it contains ideals like restriction of the number of animals to the grazing capacity, the differentiation between the essential and the non-essential cattle, etc. But it was very much in advance of the times. Subsequently also, the restriction of grazing to the capacity of the reserves was repeatedly kept in the forefront. In 1911, the Government suggested that to remedy the existing overgrazing, a trial should be made of the effect of enhancing the fees for cattle, so reducing the pressure on the reserves and inducing the ryot to pay more attention to the value of animals he kept. The following year, the Horne Committee was appointed and its principal recommendation was the reclassification of forests and the handing over to panchayat management of certain forests where grazing was important. The Committee recommended the retention of the grazing fee and the exclusion of goats from all Government reserves. Further it recommended that blocks intended for the grazing of the district or migratory cattle should be carefully fixed, with due regard to the extent of the block and the water-supply. This Committee has recorded that attempts to discriminate by Government agency, between agricultural and domestic and other cattle, or between privileged and non-privileged cattle, proved a failure and that for some years all cattle covered by permits were allowed to graze irrespective of possibility of the forest. As a result of the gradual denudation of the unreserve, the pressure on the reserves for grazing also increased. Any restrictions placed on the old-time practice of unlimited and unrestricted grazing, even in the most important reserves left to the management of the Forest department, were repeatedly opposed and criticised in the Legislative Council. Complaints were frequent against the closure of felled fuel coupes and against the 'Block system.' The latter was abolished in 1925 and a single permit was made valid for a whole range and then to the whole division. Thus the policy of regulating grazing to what the forests can bear has receded to the background. One of the recommendations of the Royal Commission on Agriculture was that the intensity of grazing consistent with the proper development of the forest and the preservation of desirable grasses, should be determined. Schemes also should be devised for the improvement of grasses grown in forests. These recommendations have not been given effect to.

25. *Present position.*—Anyone who inspects the reserved forests will begin to realize the folly of uncontrolled grazing, as at present practised over large areas. This has led to the

progressive reduction of the quantity of fodder produced. Agitation still continues in regard to forest grazing from people living near reserved forests, as they have for many years enjoyed a great deal of cheap grazing without restriction. Combined with this unrestricted grazing, the pernicious habit of setting fire to the forests every year had led gradually to the replacement of good grasses by fibrous ones of low palatability and fodder value.

26. *Causes of deterioration of forest pasture.*—To sum up the steady deterioration of forest pastures of our State is due to the policy of appeasement adopted by successive administrations, in that the grazing has not been limited to the carrying capacity of the area and to the habit of the public in setting fire to the forests annually.

27. *Grazing outside reserves.*—Under this category will come not only the Government lands (waste lands and porambores, etc.) but also the agricultural and other lands owned by private people. When, even in reserved forests, where the Government have complete control, a deterioration of fodder resources has set in, the position cannot be better outside it. There is absolutely no management of grazing in Government lands outside reserves and no planned cultivation of the agricultural land. Whereas, goats and also sheep in some districts are not allowed to graze inside reserved forests, outside them there are no such restrictions. In fact the management of unreserves and porambores are very nominal, in many districts. Further, under the existing rules, outside reserved forests, anybody can go and break up any land for cultivation, unless it is placed in the prohibitory list, and then get such a land assigned to him if he wanted it. Otherwise he can always abandon the land. The cultivation, especially of the dry variety has expanded so much, that even marginal lands which will not bear repeated cropping have been taken up for cultivation. If the rains are favourable such lands will no doubt, yield a small crop and the crop residue will become available as fodder for cattle. But when the rains fail, the crops also will completely fail and even the little grass, which such lands yield even in years of drought if left alone, will no longer be available. If such lands are given rest, they will soon become good pasture lands especially if some attention is bestowed on them. But they do not get that rest, as they will be again ploughed up, when the next favourably rainy seasons occur.

28. *Details of areas cropped and the trend of cropping.*—The statement given below gives the details of the net area sown, current fallows, area under non-food crops, area under fodder crops and other uncultivated land, other than current fallows, in 1,000-acre units. The periods 1902 to 1905, 1925 to 1928 and 1944 to 1947 have been considered.

Year.	Net area sown.	Current fallow.	Area under non-food crops in 1,000 acre units.	Area under fodder crops.	Other uncultivated land other than current fallows.
(1)	(2)	(3)	(4)	(5)	(6)
	ACS.	ACS.	ACS.	ACS.	ACS.
1902-03	25,740	5,203	309 *	189	5,979
1903-04	25,689	5,694	317 *	228	5,623
1904-05	24,151	7,235	315 *	238	5,863
1925-26	33,834	10,144	8,754	388	12,352
1926-27	33,263	10,874	8,103	455	13,218
1927-28	33,793	10,087	8,697	423	13,271
1944-45	31,534	9,296	9,031	460	11,434
1945-46	30,584	9,779	8,849	463	11,953
1946-47	31,085	8,785	8,785	563	11,849

* These figures represent only the total of miscellaneous non-food crops.

The total cultivable area of the State in the year 1946-47 was 52,383,100 acres.

In the year 1946-47, out of 52.38 million acres, the total cultivable land of the State, nearly 11.8 million acres were uncultivable land. Most of these lands are hardly cultivable at all and even if cultivable, they could be cultivated only at very little profit. Out of the remaining lands, the net area sown was 31.0 million acres, while the current fallows, accounted for nearly 9.5 million acres. It is this large extent of current fallow lands, which neither produce food crops regularly, nor sufficient grass when they are fallow which are responsible in no small measure to our fodder scarcity. These current fallow lands which were only 5.2 million acres in 1902-03 very rapidly increased to 8.2 million in 1907-08. It was about 11.2 million acres in 1934-35 and ever since it is varying between 9 and 10 million acres. Cultivation of these marginal lands means so much utilization of extra animal power for obtaining what at best will be marginal yields in years when seasonal conditions are favourable. In years of drought these current fallow lands hardly contribute any grass fodder, even for the cattle which are required to plough them. Some of the best grazing lands of the State have thus been taken up for cultivation, e.g., the 'bidu' lands of Guntur.

29. *Non-food crops.*—When there is so much scarcity for food and fodder it will probably be considered unsocial to grow money crops like tobacco, groundnut, cotton, etc. There are at present nearly 9 million acres under non-food crops in our State. In 1925-26 it was about 8.8 millions and from that year onwards every year its extent is varying between 8 and 9 million acres. In certain areas food crops have been replaced by non-food money crops which yield no cattle fodder at all.

30. *Very small area under fodder crops.*—Out of nearly 31 million acres of wet area sown each year, the area under fodder

crop is very negligible as can be made out from the following statement :—

Year.	Area in acres.	Year.	Area in acres.
1910-11	264,371	1944-45	459,653
1920-21	298,872	1945-46	463,463
1930-31	449,865	1946-47	562,794
1940-41	459,455		

Tradition has it that the Hindu Kings and their Muslim successors used to insist, even in the olden days when the pressure on land was not so heavy, on the ryots growing fodder at least over one-tenth of their cultivated lands. If this good custom has been in force, the target for fodder crops in our State should be about 3 million acres as against the present half a million acres. This just illustrates how reluctant the public are to grow a fodder crop, because it does not directly give them a monetary return.

31. *Causes of present fodder scarcity.*—To sum up in areas outside reserved forests the fodder scarcity is due to

(1) progressive deterioration of pastures in poramboke and other lands belonging to Government, due to unrestricted and unregulated grazing and annual burning;

(2) breaking up of pasture lands for cultivation;

(3) increase of area under current fallows;

(4) a probably large extent under non-food crops; and

(5) a very small area about 1.5 per cent of the net area sown under fodder crop.

CHAPTER III.

THE FODDER AND GRAZING COMMITTEE.

32. *The constitution of the Madras Fodder and Grazing Committee and a brief resume of the work done by it.*—At the instance of the Government of India, the Government of Madras in their Order No. 1703, Development, dated 14th July 1938, constituted an advisory committee called Provincial Fodder and Grazing Committee. The member of the Board of Revenue in charge of panchayat forests is the *ex officio* Chairman. The Secretary of the Board of Revenue dealing with Forest Panchayats is the *ex officio* Secretary of the Committee. The Director of Agriculture, Chief Conservator of Forests, Chief Engineer for Irrigation, Director of Animal Husbandry, Livestock Development Officer are the *ex officio* members. A few prominent non-officials and officials who take an interest in cattle and their feed are also members of the Committee. This Committee discusses important schemes relating to cattle and their fodder supply and

takes suitable action in getting them sanctioned. At the instance of the Committee, a report was prepared on the condition of the panchayat forests of the State and the measures that should be adopted to preserve and improve them. The Committee itself has published a memoir containing statistics of existing live-stock and of the fodder production and an atlas illustrating the same.

33. *Resume of the work done by the Madras Fodder and Grazing Committee.*—A brief resume of the work done by the Madras Fodder and Grazing Committee is given below :—

(1) The possibility of creating fuel and fodder plantations in panchayat forests by the kumri method was considered and the Committee recommended to the Board, the granting of reduction in lease amount to those panchayats which planted approved trees in an approved area.

(2) The conduct of experiments in early cutting and quick drying of grass was recommended to the Government. The results of the experiment were considered and the Committee decided that if a demand should materialize for well-cured hill hay, it should be met, provided the cost of production was realized.

(3) At the instance of the Committee, the Government sanctioned the Scheme of Rotational Grazing in Talamalai Extension Reserved Forests, prepared on the principles of the special block system.

(4) The Committee recommended to the Government, the proposal of the Chief Conservator of Forests to keep stocks of hay in Nallamalais, to meet the recurring scarcity of fodder in Ceded districts. But the Government turned down the proposal, as they had already issued orders to the Collectors to persuade villagers in the dry districts to maintain common reserves of fodder in the form of silage to meet the recurring scarcity of fodder in those districts.

(5) A Rotational Browsing Scheme for goats was considered and it was dropped as it was correlated with the imposition of a tax in some form on goats.

(6) Experiments on pasture research, live fences and hot weather fodder supplies, which were conducted by the Special Grazing Officer were considered and wide publicity given to the results of the experiment.

(7) A scheme for maintaining a fodder reserve in Anantapur and Kurnool West Forest divisions, proposed by the Chief Conservator of Forests was recommended to the Government. The Government approved the scheme.

(8) The Committee considered the possibility of introducing rotational grazing in panchayat forests. The general feeling was that nothing could be done in the matter except to await

the orders of the Government on the question of future control of forest panchayats.

(9) At the instance of the Committee, the Government have stated that fodder trees may be grown in waste lands at the disposal of Government under certain conditions.

(10) The Committee recommended to the Government the desirability of forming grazing ground porambores in suitable localities, in all districts and improving them by the 'kumri' method.

(11) The Committee considered the importance of contour bunding, in areas of low rainfall, as a practical method of improvement and control of grass land and recommended the same to Government for trial, in suitable areas.

(12) The Committee recommended to the Government the proposal of the Chief Conservator of Forests to conduct experiments in the manufacture of hay (1) to provide data on the possibility of keeping a fodder reserve capable of being transported to areas of scarcity; and (2) to make use of fodder in the reserved forests which would otherwise go to waste.

(13) The Committee considered the suggestion of restricting the groundnut crop in Ceded districts in favour of a fodder crop, and decided that the Director of Agriculture should be requested to arrange for propaganda among the ryots, to discourage the tendency to grow groundnut as a mixed crop with mungari cotton and to induce them to rotate jonna with groundnut or cotton.

(14) The Committee decided that the Agricultural department should carry on intensive propaganda for including fodder crops in the existing cropping system and that the agricultural farms and demonstration depots should stock sufficient quantity of seeds of suitable fodder crops.

(15) The Committee resolved that the District Forest Officers should stock seeds of suitable fodder trees to distribute to the public who wish to grow such trees in their private lands.

(16) At the instance of the Committee, the Government agreed to the extension of the concessions on growing fodder crops to zamin tracts as well.

(17) Alkali treatment of straw was considered by the Committee and it resolved not to conduct local experiments in the manufacture of straw pulp, but watch results of similar experiments conducted at Izzatnagar.

(18) The Committee recommended to the Government the proposal to open experimental farms for growing grass and fodder crops, under large systems of irrigation. But the Government turned down the scheme on the ground, that it was not likely to appeal to the ryots either during or after the war and that at that time (war years) the ryots should not be encouraged to grow grass, instead of paddy, on irrigated wet land.

(19) At the instance of the Committee the Government approved the proposal of Director of Agriculture to distribute seeds of fodder cholam, free of cost to ryots in Udumalpet and Palladam taluks.

(20) The Government commended the suggestion of the Committee to the municipalities and major panchayats of the State to grow fodder crops with sewage water.

(21) A scheme for mixed farming in Pattukottai Agricultural Farm was approved by the Committee and recommended to Government.

(22) The Committee recommended that takkavi loans in kind, of groundnut cake and cotton seed be granted up to the value Rs. 50 on the same terms as loans for manure.

(23) The Committee recommended the remission of half assessment to ryots who cultivated fodder or green manure crops on dry lands.

(24) The possibility of utilizing city sewage water for raising fodder crops was considered by the Committee and it observed that it was an economic waste, not to utilize the city sewage for constructive purposes, but merely to run it into the sea. It recommended that it would be worth while for the Government to subsidize any feasible scheme for utilizing the city's sewage for growing fodder.

(25) A scheme for the preparation of silage in selected areas of Ceded districts and Coimbatore and distributing the silage to the ryots was recommended to the Government.

(26) The proposal of the Director of Agriculture to start experiments in cutting 50 acres of paddy three times and feeding the straw to milch cattle in Madras was recommended to Government. The Government turned down the proposal as not economic.

(27) A scheme for the opening of an Agrostological section and for breeding better types of fodder grasses, submitted by the Director of Agriculture was recommended to the Government.

(28) The Committee considered the reports of Sir John Russel and Doctor Wright on the general policy to be pursued for the improvement of fodder and grazing and resolved to recommend to the Government that experiments be initiated, by the Agricultural department to ascertain the nutrient value of fodder crops at different stages of their growth, to evolve the most suitable fodder crops, to find out the most suitable rotation of such crops, with other crops.

(29) The Committee recommended to the Government for sanction the scheme of the Director of Agriculture to lease out an extent of 6 acres of land near Mangadu near Madras, to try out different fodders which will be useful for milch cattle of Madras. The farm has been started.

in that tract. This system dates back to 1874. It was abolished in 1898, only to be reintroduced in 1902. In 1911-12, there were 129 kanchas in the Nellore Division, extending over 126,329 acres. Out of this, 25 were foreign kanchas and the rest local kanchas. Foreign kanchas are intended for the use of foreign cattle and the District Forest Officer has discretion to change them for use by local cattle. The local kanchas are to meet the demands of the villages within five miles of reserved forests. If the area of the local kanchas is found in excess of local requirements, foreign cattle may be admitted at the discretion of the District Forest Officer. The possibility of a kancha is fixed at an average of two acres per cow or buffalo unit, except in the case of certain reserves where the possibility is fixed at four acres per cow unit. Permits are issued departmentally up to the capacity of the kancha at the following rates:—

	Local.	Foreign.
	AS.	AS.
Buffalo	10	12
Cows or bulls	8	10
Sheep	3	4

The kanchas are closed to grazing for three months in the year from the 1st of July. This is the most important and the best feature of this system as this closure gives an opportunity to the grasses to develop before they are grazed down.

37. *Present grazing policy.*—In G.O. No. 1612, Development, dated the 13th August 1942, the Government generally approved the recommendations of the Special Grazing Officer. These orders form the basis of management of forest grazing, though effect has not yet been given to them. These recommendations are discussed below. The first suggestion of the Special Grazing Officer was that the forests should be classified as major or minor, the criterion being the relation grazing is to bear to forest management. Minor forests would include marginal reserves not worked on an intensive basis, the object of which is to meet local demands up to their capacity. It is only in such forests which will bear the brunt of forest grazing, the Government had specifically asked the Special Officer to introduce the block system, limiting the number of cattle to the capacity of the forest. The Special Grazing Officer's proposals made in this connexion were—

(1) reintroduction of the old block system in all areas classified as 'Minor Forests' and superimposing on it, the principles of limiting the cattle to the carrying capacity of the pasture—He called this the Local Block system;

(2) by developing much smaller special blocks near villages, offering special facilities such as grazing of exceptionally good quality. This was designated by him as the 'Special Block system'; and

(3) by developing penning blocks in all major forests to the extent possible, the Penning Block system.

These proposals are discussed below.

38. *Local Block system.*—The essence of the Local Block system lies in limiting the grazing to a limited stock. Limitation will be only regarding the number of cattle to be admitted and not to the period of utilization. The carrying capacity of the block will have to be determined until sufficient experimental data become available. The Special Officer suggested the adoption of the following methods:—

First determine the effective grazing area by excluding areas occupied by outcrops of rocks and inaccessible slopes. Then on a basis of an eye estimate of density of cover, combined with the quality of the grazing offered, allot the carrying capacity between 3 and 6 acres per cow unit, on the effective grazing area already determined.

As cattle in excess of the carrying capacity will have to be excluded on a rational basis and as local cattle should enjoy a preferential treatment, the Government have accepted that the first cattle to be admitted should be the essential cattle of the adjacent villages followed by the non-essential cattle of the same villages. This leads to the necessity for determining essential and non-essential cattle. The basis of such a determination was to be on the ryots holding and the Government approved the following basis, as recommended by the State Fodder and Grazing Committee:—

Area of holding.	Essential cattle.
Up to 2 acres.	2 units.
2 to 5 "	3 "
5 to 10 "	4 "

and for every subsequent 5 acres, 1 unit extra.

39. *Criticisms of the above and suggestions for the future.*—Theoretically the Local Block system is all right and when actually administered, possibly it can be made popular by not prosecuting trespass into the other blocks. But the real difficulty will become apparent when a grazing settlement is based on the above scale, because all the village cattle will come under the 'Essential' class. The average holding of 94 per cent of the pattadars of the State, who hold nearly two-thirds of the cultivated area and pay an assessment of less than Rs. 30 each, ranges from 0.63 acre to 6.56 acres with a mean of 3 acres. For 3 acres, the minimum number of essential cattle according to the scale approved will be 3 units. This works out to 1 unit for an acre of cultivated area. Actuals will be more because the minimum anybody will be allowed will be 2 units. As has been mentioned earlier in this report, Madras State keeps only 75 animals for every 100 acres of cultivated land, i.e., 25 less than the minimum number which may be treated as essential under this scale.

Probably this aspect of practical detail was not fully considered. Further, division into blocks combined with no prosecutions for trespass into the adjacent block is as good as the present system. Even under the present system of division-wide permit, cattle rarely stray more than 4 to 5 miles from their homes. So extending the validity of the grazing permit to a whole district, in practice amounted only to a gesture, a concession rarely availed of. In the circumstances, it will probably be not necessary to re-introduce the old Block system as this may not lead to the improvement contemplated. Limitation of the number of grazing cattle is the most important thing. It has just been shown that the grazing settlement on the lines approved will not be very helpful because all the cattle now kept will come under the essential class and the Settlement Officer's job will not be an enviable one. The usual complaints will be made. Taking all these factors into consideration, the best procedure will be to make the ryot himself gradually decrease the stock and bring it down to grazing possibility of the forest. The only way in which this can be achieved is by increasing the grazing fees. In 1945-46, the grazing revenue of Rs. 4,07,923 was obtained from licensing 1,825,805 animals. This works out to 3-6 annas per animal for a year's grazing whereas for about 30 lb. of green grass, a day's ration for an ordinary animal, the public pay at least 8 annas. It is high time that the grazing fees are increased, *gradually* till the number of reserve going cattle is brought down to the number which the pasture can bear. Any other system based on essential and non-essential cattle, will not work so smoothly and efficiently. Moreover, grazing settlement, demarcation of blocks, etc., do cost money. In the circumstances, the only practical measure which will help in bringing down the number of cattle grazing in the reserves, is to increase the grazing fees gradually.

40. *Special Block system*.—According to the Special Grazing Officer the object of the Special Block system is the segregation of exceptionally good grazing areas which are near villages and managing them on an intensive basis so as to offer grazing of exceptional quality to good animals and to ensure that such areas are not allowed to degenerate through misuse as is bound to occur if they are merely treated under Local Block system. These special blocks were mostly intended to include recently felled fuel coupes, which, as a result of closure, develop a heavy stand of grass. To retain the improvement, deferred and rotational systems of grazing were suggested. Ultimately, the whole of the Fuel Working Circle, a considerable area, which covers practically the whole of the peripheral strip will come under this special block. Special fees are chargeable for these special blocks. In 1945-46, rotational form of grazing was practised over 122,169 acres and the total grazing revenue obtained was Rs. 12,578.

41. *Suggestions regarding the future of the special blocks*.—An inspection of typical localities, where rotational grazing has been tried shows that personal factor plays a large part in making

rotational grazing a success. In one division, even the rotational grazing demonstration plot failed. The apathy of the public is always there, though they do realize the value of rotational grazing, when explained to them. In certain localities rotational grazing will rarely succeed, because the farther block will always be quite a distance away from the village. Taking these factors into consideration, it is suggested that rotational grazing should be limited only to localities where the people and the concerned officers are keen. For rotational grazing to succeed, the paddocks must be properly fenced, and the closed paddocks must get real rest from grazing. More than this, the co-operation of the public is very essential. If these cannot be achieved there is no point in experimenting with rotational grazing for an unsuccessful experiment will do more harm than good. So it is suggested that the present rotational grazing blocks may be reviewed critically and closed down where they do not conform to real rotational grazing.

42. *Grass land management*.—Mere deferred and rotational grazing, even under the most favourable circumstances, may not improve the pasture beyond a certain stage. Most of our grass lands are just inferior pastures at the moment, due to abuse in the past on account of overgrazing and burning. To improve the pasture, manurial treatment, rest, disking, harrowing, ploughing and reseeded with legumes and grass seeds are all necessary. That an untreated grass land deteriorates progressively is borne out by the following figures given on page 16 in 'Grass land Husbandry' by H. I. Moore.

Treatment.	1938.	1939.	1940.
	TONS PER ACRE.	TONS PER ACRE.	TONS PER ACRE.
Ploughed and reseeded ..	13.07	12.78	11.62
Renovated spring, 1938 ..	6.0	7.01	6.00
Untreated grass land ..	3.97	4.06	2.00

(Renovation consisted of drastic pitch-pole harrowing followed by a complete manurial dressing as given for the reseeded area and the sowing of a seeds mixture.)

It is not all forest lands which are capable of being improved in this fashion. Usually lands which are suitable for *Kumri* cultivation will be suitable for ploughing and reseeded with grass seeds, though of course a great depth of soil may not be necessary. When Forest Working Plans are prepared, areas suitable for improvement in this fashion, as pasture lands, must be selected and provision made for improving their pasture value. After improvement, such lands should be treated as special blocks and subjected only to rotational grazing. Ultimately when the grass stand becomes poor, the area should be again reseeded to good pasture. To sum up the suggestions are (1) to limit rotational grazing to select localities where the public and the departmental officers are keen and scheme will have good chances of success and (2) to bring under scientific management suitable grass lands.

43. *Necessity for a Special Officer.*—Scientific grass land husbandry and pasture management are new to the Forest department. The department did not take to this activity hitherto as grazing fees were very nominal and more than this restriction and regulation of grazing could not be enforced. Now that the Government have approved the formation of special blocks, which can be managed separately, scientific pasture management can be taken up seriously, at least in such blocks. To facilitate this, there is necessity for a special Agrostologist for the Forest department, who, in addition to conducting studies in reseedling and management of forest pastures, can also take up experiments, in the breeding of suitable herbage and forage plants under forest conditions. Such an officer will be in the same relation to the District Forest Officers regarding grasses as the Silviculturist is now to them regarding trees. The best proposition will be to send a Forest officer who is a M.Sc. or a B.Sc. (Hons.) in Botany for training as an Agrostologist.

44. *Penning Block system.*—A certain number of pens already exist in the interior of the reserved forests. These are located near water sources. The possibility of these pens depend on the nature of the water sources, which occur near them and the healthiness of the tract. These pens are utilized mostly by migrating cattle. The Special Grazing Officer has suggested the expansion of this system and the formation of rotational penning units. As already mentioned most of the forest grazing is confined to the peripheral strips and it is necessary and desirable to spread out the grazing to the interior forests also. The limiting factors are (1) inadequate number of water sources, (2) unhealthiness of some interior forests and (3) absence of good roads, which will facilitate the rapid and easy movement of cattle to the interior grazing areas. It is suggested that the extension of this penning system should be vigorously undertaken, and, to this end, the following steps will have to be taken to counter the limiting factors: (i) Survey of underground water sources and the sinking of bore wells, (ii) anti-malarial operations wherever necessary and (iii) opening out of interior forest areas by a network of roads. It is specially necessary to undertake this work in the Nallamalais, Palkondas, Seshachallams, Javadis and the Agency forest areas at a very early date as pens when formed in them may be utilized (1) by the old and decrepit cattle of the State and (2) by the cattle from famine tracts in the case of Nallamalai pens. It is understood that the financing of concentration camps in interior forests will be borne entirely by the Central Government. In these circumstances it is suggested that steps may be taken to have an hydrological survey done immediately in the tracts mentioned and to prepare schemes for sinking bore-wells and for forming roads in the tracts mentioned so that the pens may be ready to receive the pinjrapole cattle as soon as possible.

45. *Famine hay operations.*—Fodder scarcities occur at infrequent intervals in Anantapur and Bellary districts. At such times arrangements are made to supply dried forest grass to the cattle of the scarcity areas. Temporary fodder divisions are formed in a hurry and by the time the supplies of forest grass are made available, valuable time is lost and much distress is felt. Given favourable conditions about 5,000 tons of dried forest grass can be produced in a season, which commences from about November and December and lasts till June or July of the succeeding year. In the 1946 famine hay operations a ton of hill grass was produced at a cost of Rs. 65 per ton and this was sold to the cattle owners in the scarcity areas at a subsidized rate of Rs. 24 per ton. Even at this rate, considerable stocks were left unsold. The Collector of Bellary in his notes on the famine operations of 1946 has written that—

'Hill grass is such a poor stuff that cattle owners do not ordinarily use it for their cattle. It is only as a last resort that this stuff is used.'

The Collector has also mentioned that only cattle in red soil villages eat this forest grass and that the cattle in black soil villages do not eat this grass because if they do eat them, they would purge and die. This latter statement does not accord with the experience of the Superintendent of the Hagari Farm, which is located on black soils, as his cattle were fed only on hill grass during the scarcity period. In the Military Dairy Farm at Bangalore it is only this hill grass obtained from Bellary and from Nallamalais, which is used for the milch animals and so the complaint about their quality may have to be reviewed, in this light. Though it has to be conceded that the relief given may not benefit more than 1 per cent or 2 per cent of the cattle population in the affected zone, yet it has to be undertaken.

46. *Future of famine hay operations.*—Fodder is a bulky product and it will not bear transport over long distances. So, a lasting solution will be to create famine fodder reserves in or near the villages themselves. Steps to achieve this objective will be suggested at the appropriate place. But till those steps are adopted and made a success, famine hay operations may have to be undertaken in the forests of Anantapur, Bellary and Kurnool West Forest divisions. To save valuable time, the following measures are suggested. Hill grass is now being sent from Tornagallu Military Grass Farm to Bangalore and elsewhere. The grass is costly because it has to come from a long distance, and the labour is scarce. The officer in charge of the farm is of the opinion that cheaper grass can be produced at Gazulapalle near the Nallamalais and that there are also contractors there who can undertake to supply large quantities of grass. In the circumstances the suggestion will be—

(1) to arrange with Military authorities to have their grass farm shifted from Tornagallu to Gazulapalle, and

(2) to request the Military authorities to keep always a reserve stock of about 500 tons of dried grass so that they may be utilized for meeting urgent civilian needs at the commencement of periods of fodder scarcity. The understanding will be that the Forest department will return the 500 tons as soon as their famine operation gets into full swing. Any facilities which the Military department may require in this connection should be considered favourably.

In the alternative if the Military department is not keen on this idea of starting a grass farm at Gazulapalle it is suggested that the Forest department may start a unit there for collecting hill grass and supplying the grass to the Defence department. It is understood that the Military require large quantities of hill grass for their dairy farms. Such a unit can always meet urgent civilian demands from the reserve stock it will have till the regular famine lay operations start. Supply of grass to the Military department will be a regular commercial proposition.

47. *Estimates of outturn.*—According to a 1946 estimate the following quantities to dry forest grass may be expected from the centres mentioned :—

	TONS.
<i>Old Anantapur Division—</i>	
Hospet-Kanevahalli	50
Mariammanshalli	75
Ramgad	200
Yeshwant Nagar	500
Salehalli and Tumaragudi Sidiy	225
Kudatini and Papanayakana halli	150
Rangapuram	300
Total ..	1,500
<i>Kurnool West Division.—</i>	
Gazulapalle	1,000
Chelama	1,000
Total ..	2,000
<i>Kurnool East Division.—</i>	
Diguvametta	1,500

A further 500 tons can be obtained, it is believed from Kothakotta and Janavulapalli Reserved Forests and Tadpatri Panchayat Reserved Forests. After the above estimate was prepared, many big panchayat managed reserves have reverted to the Forest department in Bellary and Anantapur districts. These panchayat reserves did not supply any grass in the previous famine operations, because probably there was no organization then to undertake such

supplies from those forests. Now that they have reverted to the Forest department, schemes for supplying grass from them also, in times of scarcity, will have to be prepared and the old estimates of outturn given above revised if necessary.

48. *Pens in Nallamalais and cattle from fodder scarcity areas.*—The best way of utilizing the forest grazing is for the cattle to graze them. As has been mentioned already supply of dry grass involves much subsidy and in spite of this, the public too do not seem to appreciate the grass supplied to them, according to the Collector's report. In connexion with the salvage of pinjrapole cattle, the opening of pens in the interior of Nallamalais has already been suggested. Some of these pens and also other pens in Nallamalais will be vacant during the months when famine usually occurs in Bellary and Anantapur districts. When famine conditions actually appear, such pens can be used for penning cattle brought from the scarcity areas. The most satisfactory procedure will be to buy the cattle from the scarcity areas early in the famine period and have them transhipped to railheads in Nallamalais and take them from there to the different pens. After the famine is over, these cattle can be resold to the ryots of the famine zone. In the alternative, private cattle owners can be given facilities to send their cattle to these pens during famine years. The department and the officers who will look after the pinjrapole cattle may look after this arrangement also.

49. *Silage and hay.*—It is suggested that all facilities may be given to villagers, living within economic distances of reserves, who wish to have common reserves of fodder either as silage or as hay. They may be given the grass free of charge, and if they so desire, they may be permitted to form their silos inside the reserved forests. We should like to suggest that in deserving cases, subsidies may be freely given for the erection of silos outside reserves. Inside the reserved forests, the Forest department may consider the suggestion of having silo pits or towers constructed at its expense for the ryots' use. Steps must be taken to make silage and hay making popular. In the Nallamalais, we understood that ryots come at the proper seasons and cut the grass, mostly spear grass, and leave them in the forests to dry. When dry, these cut grasses are removed. This is a very good practice and we suggest that steps may be taken to extend this practice to other divisions also.

50. *Summary of suggestions relating to reserved forests.*—The following is a summary of suggestions made regarding reserved forests which, if adopted, will make for better grazing for a larger number of cattle :—

- (1) gradual increase of grazing feeds till the number of reserve going cattle comes down to what the forests can bear ;
- (2) inspection of present rotational grazing blocks and closing down those which do not conform to real rotational grazing ;

(3) bringing under scientific management and treatment suitable grass lands;

(4) appointment of a Special Forest Officer with training in Agrostology to conduct research experiments in management of forest pastures and in breeding suitable herbage and forage plants, under forest conditions;

(5) developing penning system, to distribute grazing to the interior forests also;

(6) opening of a grass farm at Gazulapalle in Kurnool district either by the military or by the Forest department, for meeting the military demand for grass ordinarily and for meeting in an emergency, the demand from civilian population;

(7) revision of estimates of supplies of grass from the different reserves of Anantapur and Bellary districts including the panchayat forests which reverted recently;

(8) utilizing the proposed pens in Nallamalais during famine period, for keeping cattle brought or bought from famine zones; and

(9) popularizing the manufacture of silage and hay.

CHAPTER V.

SUGGESTIONS RELATING TO GOVERNMENT LANDS OUTSIDE RESERVED FORESTS.

51. *Introduction.*—We have so far dealt with reserved forests and steps which, if taken in them, will increase their fodder content and at the same time ensure a better utilization of the available forage. Next we shall take up for consideration the outturn of fodder in lands at the disposal of Government excluding reserved forests. The other uncultivated lands excluding current fallows which are described in the Season and Crop Report as waste remitted and unremitted, amounted to 9,498,721 acres in 1944-45. These together amounted to 21.3 million acres, while the net area sown amounted to 31.0 million acres. On the successful management of these lands for pasture, our solution will greatly lie.

52. *Present management of porambores which are available for cultivation.*—The management of porambores now vests in the Revenue department. Certain rules have been drawn up for the management of certain portions of them called 'unreserves' which contain tree growth. In the porambores, there is no restriction either regarding the number of cattle grazing in them or the type of animal. Goats which are specifically excluded from reserved forests are permitted to browse in them. The management of tree growth in these unreserves is highly nominal. Some low seigniorage rates were fixed years before for removing timber

and firewood from these unreserves for *bona fide* domestic purposes or for meeting local needs. These rates which were fixed nearly 20 to 30 years ago have not been revised at all. During the war and post-war period these unreserves have been the happy hunting grounds of unscrupulous persons for becoming rich. The tree growth in them have disappeared either as firewood or as charcoal, either with or without the connivance of the people responsible for their protection. The grazing in such areas has deteriorated on account of abuse by burning, over-grazing and soil erosion. To sum up, these porambores which were intended to meet the local demands for fuel, small timber, and grazing have deteriorated so badly that the pressure for the same products has devolved to an increasing extent on the reserved forests. It is high time that the present inefficient management of these porambores is changed and steps are taken to rehabilitate and develop them as fuel and fodder reserves. The forest area of our State, which includes lands classified or administered as forest under any legal enactment, reserved forests and reserved lands, occupied only 16.8 per cent of our total area. Out of this the reserved forests, which have always been under Forest department, represent 12 per cent. The reserved forests which were handed over for popular control, and which are now slowly reverting to the Forest department represent 2.4 per cent. The rest are the zamindari forests which are managed under certain Sections of the Madras Forest Act (Act V of 1882). The deteriorated condition of the panchayat and zamin forests is too well known to be discussed here. Unless these forest areas and the other poramboke lands are efficiently managed, it will not be possible to provide fodder for the millions of hungry animals, which we now have.

53. *Present land assignment policy and suggestion for the future.*—In the lands at the disposal of Government, excluding reserved forests, occupied porambores and lands belonging to the Military, any person can cultivate, pay penal assessment, if necessary, and then get the land assigned to him if it is not held to be objectionable by the Revenue department. Very valuable pasture lands and also lands which are not fit for permanent cultivation like steep slopes and marginal and submarginal lands have been broken up for cultivation in this fashion. This policy or the absence of it gives only *ad post facto* remedy as eviction can be done only after the damage is done. Further such a system is repugnant to any system of scientific land planning. It is not all lands that are fit for continuous cropping. It is not in the interest of the nation to allow cultivation in marginal and submarginal lands, which should legitimately be managed as fuel and fodder reserves. Yet, according to the Season and Crop Report of 1946-47 nearly 9.5 million acres, i.e., about 11.5 per cent of the total area of our State, which is also equivalent to 31 per cent of the net area sown, and also slightly less in extent to the area of Government managed reserved forest, come under current fallows, i.e., lands

which will not either bear continuous cropping or cannot be brought under cultivation, except in favourable years. This shows that the lands best suited for permanent agriculture and can be cultivated with our existing resources, year after year, have already been occupied and gradually less economic lands have been broken up for cultivation, thereby upsetting the fodder economy of the State. Competent technical officers have remarked that our food shortage will not be made up by extension of cultivation but by adopting intensive methods of cultivation in existing cultivated lands. In the circumstances mentioned, some urgent action has to be taken to preserve our porambokes and to conserve the soil in them. Their present management which has led to their deterioration and extinction in many cases has to be changed to a management which is likely to function better.

54. *Future of porambokes.*—The first step will be to prohibit under heavy penalties further extension of cultivation in the porambokes and other lands at the disposal of Government. Next step will be to prepare plans of management for those porambokes, the objects of management being—

(1) to preserve the existing tree growth in them;

(2) to create fuel and fodder reserves in them where possible by the *Kumri* method and manage them scientifically as pasture lands;

(3) to manage the rest of the poramboke lands as natural pastures taking such soil and water conservation measures as are necessary. This incidentally will improve their pasture value;

(4) to grow where facilities for irrigation exist at present or can be created, at low costs, perennial grasses and legumes of high nutritive value like Guinea grass, Napier grass, Rhodes grass, Lucerne, Berseem, Sunnhemp, Pillipesara, etc.;

(5) to form special grass farms in accessible places, where fodder will be cut in the appropriate season, if possible by mechanised methods and preserved as silage or hay, as a summer feed or as a famine reserve.

Such a well-managed poramboke will be an asset to the nation.

55. *Feasibility of the proposals and the necessity for accepting them.*—By merely stopping cultivation in lands at the disposal of Government, improvement will take place in the fodder content of the tract. Protection of existing tree growth and raising of fuel and fodder reserves by the *Kumri* method can be organized, though in the initial stages some difficulties will be experienced. In Madurai district, fuel plantations have been raised successfully in 1946, in 1947, and in 1948 by the *Kumri* method in Government waste lands by the District Forest Officer. The other proposals too are not difficult to carry out. Suitable plans will have to be prepared for each district and the necessary staff appointed to carry them out. In our opinion, a new organization will be

necessary to take up the management of these porambokes and to manage the fuel and fodder plantations which will be raised in them and to look after grass farms and other farms which will be started in them. This will be discussed later. Some flexibility will be necessary in the management of these porambokes as they cannot be managed with the same rigidity as reserved forests are. Different sets of rules may be necessary. Details of management can be easily worked out, if the proposals outlined in this connection are approved.

56. *Future of current fallows.*—As has already been mentioned there were nearly 9.5 million acres of current fallow lands in 1946-47. It has also been mentioned that it is not these marginal and submarginal lands which will solve our food problem. These lands should normally be reverted to pasture. The possibility of doing this without giving room to controversy or opposition has to be settled in consultation with the Board of Revenue. If, however, this is not feasible, steps must be taken to reclaim these lands and improve their productivity by adopting mixed farming practices. It is only in such lands that the full benefit of mixed farming will become patent. If mixed farming is practised in most of our dry lands, the fodder problem will automatically solve itself.

57. *Mixed farming.*—Dr. N. C. Wright in his report on the Development of Cattle and Dairy Industries of India writing about the importance of cattle in Indian Agriculture, has said—

“The value of cattle as a means of raising the fertility of soil cannot be readily computed. There is no doubt that the widespread adoption of composting would greatly enhance the value of this manure. But the potential value of cattle as a means of introducing a ‘Mixed Farming’ system in India and thus of improving crop yields is incalculable. In any such system of mixed farming the introduction of leguminous fodder crops would still further increase soil fertility, while the improvement in crop yields should offset any apparent increase in the cost of production.”

He further writes that—

“If full advantage is to be derived from irrigation, I am convinced that farming in irrigated areas will have to be modified to allow the inclusion of a ‘Mixed Farming’ in which both the crop and animal husbandries play their part.”

58. *Mixed farming in Germany.*—What mixed farming has done to a sandy tract in Germany which was unfit for cultivation and had only 13 inches to 14 inches of rainfall, is described in Indian Farming of May 1911, by Dr. G. T. Wrench. In his article entitled ‘Cattle-keeping as the centre of farm organization’, he has described an experiment conducted by Doctor Bartsch in a very poor, uneconomic farm, which had changed

several hands. Doctor Bartsch started his farming with 13 sickly cattle, the legacy left to him. He first grew fodder to feed the animals. Their manure he composted and returned to the soil. This manuring produced more fodder for his animals. Cereals were sown for their straw and a legume and a fodder crop were intercultivated. In addition, tubers and roots also were grown for fodder. Legumes formed the standard fodder for rebuilding the health of the animals. With increased application of farm yard manure, increased quantities of fodder and food crops were obtained. To ward off the severity of gales, a wind belt of trees was raised. Gradually, peas, lentils, clover and lucerne, things which could not be grown previously on that soil, began to appear. Doctor Bartsch characterised this regeneration of the land as the biodynamic method of regeneration. As a result of this treatment, cattle, improved in health, began to calve. By the application of predigested manure and compost, the quality of the fodder began to improve. The land gradually became a true home not only of the cows and their attendants, but a home for plants and birds and insects, everyone working to help the common object of the blossoming forth of life.

59. *Mixed farming in Italy.*—In his article on 'Cattle Problem', Mahatma Gandhi has quoted extracts from a letter written to him by Mr. A. Galletti, a former civilian Collector of our State, about the Italian practice of growing fodder for cattle, even in small holdings. Some of these extracts are given below as the conditions in Italy appear to be similar to those of Madras :—

"We irrigate the meadow in Lombardy as the paddy field. We still keep there bullocks strong to the plough and cows that yield 1,000 seers of milk a month. We sow fodder crops for them by the hand. We devote half our land by rotation to pasture for them.

"When paddy was introduced and grew year after year in the same fields, the cattle had to be driven away to the hills in summer, which is our season there for the growing of paddy. But sowing paddy year after year in the same fields has been given up long ago.

"Every Indian should devote three-fifths or two-thirds of his land to growing grass and fodder for his cattle. I assure him he will not be a loser."

But the most important extract is the following :—

"I do not think the soil or climate of Lombardy is superior or even equal to those of deltas of the Ganges, the Godavari, the Kistna or the Cauvery for paddy growing. The season in Lombardy when it is hot enough is so short that it is with difficulty they can scramble out one crop a year. The official figure for the average yield in North Italy is 44 quintals a Hectare, i.e., nearly 2 tons to the acre. The official figure for most parts of India is well below 1,500 lb. an acre.

"The common rotation there (Ravenna) is 2 years paddy, then 2 to 5 years lucerne, so that five-sevenths of an estate may be under fodder and only two-sevenths under paddy. Indian conditions are very nearly reproduced there: the flat swampy country is not unlike Bengal; paddy is not cultivated with care or much manured and made to yield much; but even there though the population is thick and men must eat, more land is devoted to food for cattle than to food for men; and there too the cattle put all Indian cattle to shame."

The extracts given above from Mr. Galletti's letter reveal how difficulties similar to ours have been overcome in Italy.

60. *Results of mixed farming in United Provinces, Central Provinces and other Provinces.*—The following is taken from the Annual report of the Indian Council of Agricultural Research for the year 1946-47 :—

"The mixed farming in the United Provinces, Central Provinces, Berar and North-West Frontier Provinces financed since 1941 terminated. The idea underlying the mixed farming experiments was to ascertain the best combination of crops and animals on a holding so that the fertility of the land could be maintained by the return of manure to the soil, enabling economic production of crop and animal. The results achieved under these schemes indicate that mixed farming is more profitable than the ordinary farming. By keeping a few milch animals, an additional income is derived from the milk and the milk products and the progen of the cattle. In addition, the manure produced from these cattle increases the fertility of the soil thereby increasing the outturn per acre. Under mixed farming experiment, the rotation of the crop is so adjusted as to have fodder from the same area without affecting the produce of the food crops."

61. *Importance of mixed farming practice to Madras.*—The results of the experiments conducted in mixed farming both in foreign countries and in India have been given here first to emphasize the importance of this practice in solving our food and fodder problem and to show the unity of animal, plant and soil. In Latin America also where the condition of cattle was deteriorating, it was discovered that only a system of mixed farming was essential for obtaining a good yield of plant and animal products as well as for the elimination of animal disease and the conservation of soil fertility. The same country also discovered that rotational cropping is another method of keeping up soil fertility as the disadvantages of mono cultivation have become patent. In the course of rotational cropping a green manure crop may be grown to revive exhausted soils. The practice of rotation, so important but so little practised, is a factor which contributes to the complete use of the land. To revert, the health of human beings, animals, plants and soils are all closely inter-related and the way in which this can be maintained is that all dead animals and vegetable matter should be returned to the soil so as to live

again. Sir Albert Howard's experiments at Pusa and at Indore have proved that plant diseases are due to soil disease and that the soil disease was due to the denudation of soil fertility on account of non-return to the soil, what should belong to the soil—the animal and the plant refuses and wastes. Sir Howard's work has also revealed that artificial manures are the cause of soil disease and that artificial manures lend inevitably to artificial nutrition, artificial food, artificial animals and finally to artificial men and women. He demonstrated the great value of compost manure, which is much superior to pure cowdung manure. All the above go to show that for solving our agricultural and fodder problems we must adopt mixed farming practices on a very large scale.

62. *Propaganda and demonstration necessary.*—Considerable propaganda regarding the advantages of mixed farming and the use of compost manure is necessary. In addition, it is suggested that demonstrations should be conducted especially in marginal and submarginal lands belonging to ryots, to bring home to the ryots the superior economics of mixed farming. Garden lands also should be included in such demonstrations because sufficient fodder is not grown on them for feeding the cattle they keep. In paddy lands also such demonstration plots are necessary as we are suffering from the same trouble which Italy did, of sending away cattle to the hills during paddy cultivation season. Let us solve the problem as Italy did, by growing fodder crops, without in any way diminishing the yield of paddy. These demonstrations have to be organized in all the districts. Big ryots also should be induced to adopt this practice straightaway and serve as leaders to the ryots with small holdings. Once again it is emphasised that only by adopting mixed farming practices the 9·5 million acres of current fallow lands of our State will become fit for continuous culture.

63. *Necessity for adopting mixed farming practices in the Ceded districts.*—Especially in the Ceded districts it is essential that the people should take to mixed farming. Mixed farming need not necessarily centre round a well or a water source. Growing of fodder crops, feeding the cattle well, using their manure for composting, applying the compost manure to the field, getting better yields of grain and fodder crops, is the essence of the system. This can be applied both to dry farming and wet farming methods. Many demonstration farms may have to be organized in the famine tracts of Ceded districts. Big ryots and landholders also should be induced to open such demonstration farms on their own land. Poverty does not stand in the way of rotation of crops and such crops involve no more expense than raising only single crops. In Java, the Dutch forced paddy rotation on the people, a century ago under physical threat. The population of Java had increased from 2 millions to about 30 millions during their rule and the yield of rice and sugar fields also increased proportionately. The same results can be achieved in our country also. Let us convince the ryots and not compel.

64. *Necessity for building local fodder reserves in the famine tracts of Ceded districts.*—In the early stages of mixed farming in the famine tracts of the Ceded districts, great stress will have to be laid on growing more fodder crops than necessary, because a famine reserve will have to be built up in the villages themselves. Such reserve fodder is better kept as silage, as burning of hay and straw stacks is a common feature in that tract. One year's reserve stock will have to be built up gradually.

CHAPTER VI.

IMPORTANT CATTLE FEEDS AND THEIR CHEMICAL VALUES.

65. *List of South Indian fodders, indigenous, exotic, and cultivated.*—Before dealing with the problems connected with the increasing of fodder outturn in privately owned lands, it is proposed to give some idea of the common fodder plants which occur in the State. Fairly exhaustive lists of indigenous fodder grasses, exotic grasses grown for fodder, and leguminous and non-leguminous fodder crops, cultivated in this State, and short notes regarding them have been prepared. This is in Appendix II. It is now proposed to give a few particulars about the importance and the nutritive value and chemical composition of some of our important cattle feeds.

66. *Importance of cereal straws.*—As mentioned earlier we grow little fodder crop in our State and the cattle have to depend mostly on the straws of foodcrops like paddy, cholam, ragi, etc. The most nutritive part of a plant is its grain and the residue left is very poor fodder and will be mostly unable to sustain cattle life. Yet our cattle have to depend mainly on this straw of poor quality and even this poor roughage is very much in short supply as described in the beginning of this report.

67. *Rice straw.*—Rice straw is an important fodder of this State. It is seen that the condition of cattle is poor in the rice tracts. This poor condition of the cattle in paddy tracts is considered to be due to the unbalanced nature of the rice straw feed. The nutrient values of rice straw are given below:—

Crude protein.	Fibre.	Nitrogen free Ext.	Eth. Extr.	CaO.	P ₂ O ₅	Na ₂ O	K ₂ O
2·68	32·26	45·58	0·86	0·50	0·15	0·50	1·03

Digestible nutrients of rice straw.

	Crude protein.	Total digestible nutrients.	Nutritive ratio.	Starch equivalents.
	(1)	(2)	(3)	(4)
Bangalore	0·28	49·54	154·4	30·1
Alwar District	0·44	44·78	100·2	24·5
Ans Bengal	0·44	44·07	100·2	24·1
Bihar, Kanka	0·23	50·23	..	33·2
Punjab, Kangra	0·02	41·02	..	20·3

Thus animals fed on rice straw will get practically no proteins. The total digestible nutrients are however fair ranging from 50 to 41 and the starch equivalent is about 25 on the average. The mineral contents are however ill-balanced. In lime it is poor having only about 0.5 per cent. In potassium salts it is very much in excess. It is this excess of potassium which prevents the absorption of calcium, drives out sodium, and itself gets driven out. To improve the cattle of rice tracts, the following measures have been suggested by Mr. Satish Chandra Das Gupta, in his book "The Cow in India" :—

(1) Feeding of 6 lb. of green grass for a 500 lb. live weight animal along with rice straw.

(2) To make up deficiency of protein and phosphorus about $\frac{3}{4}$ lb. of oil cake has to be given or as an alternative some legume hay about $1\frac{1}{2}$ lb.

(3) For making up the calcium deficiency 2 to 3 ounces of bone meal.

(4) A small quantity, say, 1 lb. or less of rice bran, which contains 20 per cent of oil.

(5) To counteract the almost poisonous action of potassium, a larger than ordinary dose of common salt, say, 2 ounces per day.

It is suggested that the Animal Husbandry department may consider the suitability of this ration for our paddy tracts.

68. *Dr. Sen's research on rice straw.*—Doctor Sen, Director of the Indian Dairy Institute, Bangalore, has recorded that a portion of the calcium in the paddy straw is in the form of calcium oxalate, the major part of which cannot be metabolized in the body. The absorption of the rest of the calcium in paddy straw is further hindered by the large amount of potassium salt which this straw contains. These factors are almost absent in other cereal straws.

69. *Effect of high potassium and high oxalate content.*—A high potassium content induces diuresis and consequent wastage via the kidney of a significant quantity of nitrogen. Experiments have shown that excessive potassium in a ration decreases both the assimilation and retention of nitrogen. High potassium ingestion has further been proved by research workers to depress the absorption of calcium. A large oxalate content is another peculiarity of paddy straw. Though most of it is present as soluble potassium oxalate yet a significant fraction is present as insoluble calcium oxalate. The insoluble fraction of oxalate in paddy straw thus prevents the animal from making use of a significant portion of ingested calcium.

70. *Alkali treatment of straws.*—Straw cut into 1-inch lengths are soaked for a day in eight times its volume of water, containing in solution caustic soda equal to 10 per cent by weight of the straw. As a result of this alkali treatment, rice straw lost 25 per cent of its weight. The treated dry straw became yellower and

softer to the touch. There were losses all along, both in protein and carbohydrates by the alkali treatment. The changes which occurred as a result of the alkali treatment are given in the following tables :—

Rice straw.	Crude protein.	Ether ext.	Crude fibre.	Total ash.	N free extract.
Untreated	2.68	0.83	40.4	8.57	47.19
Treated	2.51	0.60	56.0	7.25	35.61

Changes in mineral content by alkali treatment.

Paddy straw 100 lb. of dry material.

	Ca.	Mg.	Potash.	Sodium.	Phosphorus.
Total before treatment	0.52	0.47	4.52	0.07	0.22
Total after treatment	0.66	0.46	1.18	1.3	0.11

It will be seen that as a result of the treatment, the calcium gained as also sodium. But the most prominent alteration was that the potassium content became less. As a result of this leaching out of potassium, the rice straw became a better feeding material. Also on actual trial the digestibility of protein and carbohydrates had increased very much. Even allowing for the loss of weight of the straw by the treatment, there was still much greater utilization of the nutritive materials on the original weight of straw. Figures of mineral assimilation for treated and untreated straw are given below :—

	Nitrogen.		Calcium.		Phosphorus.	
	Intake.	Balance.	Intake.	Balance.	Intake.	Balance.
Untreated straw	57.4	4	23.8	1.3	13.7	1.3
Treated straw	58.3	16	22.8	3.7	11.0	4.2

Alkali treatment though beneficial cannot be adopted, as it is costly. In the circumstances, the only course left is to urge on the cattle owners, who give paddy straw to their cattle, to use an excess of common salt in the feed, to counteract the excess of potassium in the straw.

71. *Suggestions for improving the quality of the feed in the rice tracts.*—Now that the cause of the poor condition of cattle in paddy tracts is known, it is suggested that the practice of giving bone meal and larger doses of salt should be popularized by propaganda. Stress should also be laid on feeding green grass and growing leguminous fodder crops in paddy lands. Rice straw must cease to be the only or the principal feed. As rice straw is the principal fodder in our State, there is urgent need to take adequate steps in the matter.

72. *Poor value of rice bran.*—Rice bran is also largely responsible for the malnutrition of cattle in rice tracts. Rice bran contains some oil, but is poor in protein and calcium, its phosphorus is insoluble and it has an injuriously high percentage of magnesium. Rice bran was the subject of feeding tests in Bengal experiments in 1937 by Carbery and Chatterjee. (Agriculture and Livestock of India, 1938.) The All-India output of bran may come up to 10

per cent of the paddy output. Rice bran contains a very large amount of vitamin B. It has a small quantity of protein but it is very rich in oil, nearly 20 per cent. It contains over 6 per cent phosphorus P_2O_5 and 2.6 per cent of magnesia and 0.2 per cent only of calcium. The animals were given rice straw and bran as feed but they refused to take their usual quantity of ration. There was a disinclination for the feed. On digestibility trials two-thirds to three-fourths of the protein passed undigested. The phosphorus was found to be wholly indigestible. Although 10 grams should have been near the maintenance requirement, yet with 43 grams of phosphorus in the feed, there was a negative balance. This along with the poor calcium content and excessive magnesia proved that the material was of little value. Animals fed on 3 to $3\frac{1}{2}$ seers of rice bran displayed a severe loss of condition and they died.

73. *Cholam straw (sorghum)*.—Cholam straw is an important fodder used all over Madras. Both in prime and ripe conditions, it can be successfully ensiled. Ripe cholam straw can be stacked for years without serious deterioration. There are many varieties of cholam in Madras State which are extremely local in distribution. There are varieties which are grown mainly for fodder and others for grain. Some have pithy stalks while some have juicy stalks which are mostly sweet and much relished by cattle. Breeding experiments are being conducted by the Millet Specialist at Coimbatore to impart juiciness to varieties which have pithy stalks. In fact we were assured that in all breeding experiments, fodder value is invariably kept in view. A variety of cholam known as "Talai virichan Cholam" develops a straw of very inferior quality and is consequently not relished by cattle. It is suggested that the quality of this straw may be improved by suitable breeding. This is important as the variety is grown over three lakhs of acres.

74. *Digestibility of cholam and rice straws*.—The cholam and rice straws were tested for their mineral and digestibility contents in Bangalore.

		Mineral content.		
		CaO.	P_2O_5 .	Na.
Cholam straw		0.382	0.227	0.543
Rice straw		0.564	0.169	0.430

Used singly, cholam straw is a better feed than rice straw.

Digestibility trial.

		CaO.	P_2O_5 .
Cholam straw	Intake	16.0	17.7
	Balance	2.61	2.57
Rice straw	In take	27.9	11.1
	Balance	2.42	0.09

It will be seen that cholam straw gave a positive balance both with regard to calcium and phosphorus.

75. *Cumbu straw*.—Cumbu is a hardy crop generally grown on poor soil. The grains are used as human feed while the stalks are used as fodder. Usually the dry stalk is fed to the cattle and is a stand by in times of famine or scarcity of fodder. It can also be used as a green fodder and several cuttings may be taken. But there are varietal differences in respect of the palatability of the straw, and most varieties now cultivated have straws of poor quality. It is suggested that when breeding is done with this species, the palatability of its straw may be borne in mind.

76. *Ragi straw*.—Ragi straw is generally used as a fodder. According to mineral assimilation experiments, ragi straw contained the following:—

	PER CENT.
CaO	1.136
P_2O_5	0.193
N	0.511

Digestibility trials with ragi straw were conducted in three stages—

- (1) Straw as single feed.
- (2) Straw with supplement of calcium phosphate.
- (3) Straw with calcium phosphate and green feed.

The straw was found to have good assimilability of lime. Phosphoric acid was on the border line of sufficiency. When calcium phosphate was added, calcium assimilation increased. Ragi straw is a much better type of fodder than rice straw.

77. *Maize (makka cholam)*.—Maize is a high yielding fodder which can be sown practically throughout the year as a green fodder crop. It grows faster than cholam and gives an yield of heavy succulent green fodder. It is suitable for silage. It can be fed, when the grain is just getting milky. The analysis of maize is given below:—

	PER CENT.
Digestible protein	4.7
Starch equivalents	52.3
CaO	0.73
P_2O_5	0.63
K ₂ O	1.6

It is an excellent fodder crop. If this is grown for fodder, it is sown very thick and very little grain develops. This forage can be cured into a nutritious dry fodder which approaches hay from grasses in feeding value.

78. *Legumes*.—Legume hays are very good cattle feeds. They are very rich in proteins of that variety, which have a special biological value for ruminants. Legume roughages are the richest in calcium. If a sufficient quantity of legume roughage is fed, calcium deficiency is not likely to occur. One draw back of legume

roughage is that they are not sufficiently rich in phosphorus. Legumes however keep up soil fertility as their roots harbour nitrogen fixing bacteria. Some of the legumes grown in Madras are described below.

79. *Berseem-Egyptian clover*.—Berseem was introduced in India in 1894 and in Punjab in 1901. It is an irrigated leguminous crop which has spread very much in Punjab. It is a very heavy yielder. In Madras it has been only recently grown successfully in Hosur. Where it is introduced for the first time it is better to inoculate the soil with 5 to 10 cart-loads per acre of soil on which Berseem was previously grown. The seeds are mixed with earth and is broadcasted in beds prepared for the crop. The crop is frequently irrigated every 10 days according to the season. The crop is cut when it is about a foot and a half high and cuttings are repeated till the hot season sets in well. Outturns as high as 1,000 maunds are reported. It has a high nutritive ratio which favours milk production.

80. *Nutrients in Berseem*.—The protein content of green Berseem is 18.38 per cent on dry basis. The dried hay contains protein to the extent of 14.70 per cent.

Digestible protein.	Total digestible nutrient.	Nutritive ratio.	Starch equivalent.	CaO.	P.O.	K.O.
10.29	65.79	5.4	47.3	2.70	.65	3.89

Berseem hay practically behaves like a concentrate containing as much as 10.29 per cent digestible protein. Its calcium content is very high being 2.07 per cent. The phosphorus content is 0.65 per cent.

It is advisable to sow inoculated seeds of Berseem. All seeds of Berseem are not equally viable. There are yellow, red and brown seeds in the market. The germination percentages are 90 per cent for the yellow, 50 per cent for the red and 25 per cent for the brown coloured seeds.

81. *Suggestion for making extensive trials of Berseem*.—It is suggested that Berseem may be tried extensively in the State as it is a first-class leguminous fodder. Both at Hosur and at Tindivanam, it has been raised successfully under irrigated conditions.

82. *Pillipesara and sunnhemp*.—Pillipesara and sunnhemp are important leguminous fodder crops extensively grown in the Krishna and Godavari deltas. They have added value as they are excellent green manure crops as well and they fit in very well with the paddy cropping practice of the locality. The extension of these crops to other areas of the State has been recommended. Pillipesara compares very favourably with Lucerne except in protein

content. The analyses of Pillipesara and sunnhemp are given below:—

	Moisture.	Ash.	Protein.	Fat.	Fibre.	Soluble carbohydrates.	Lime.	P.O.
Pillipesara (Phaseolus trilobus).	10.73	12.40	11.42	1.26	22.06	41.43	2.60	0.40
Sunn hemp (Crotalaria Junces).	70.90	12.89	2.04	0.28	9.45	11.66		

(Shage) Original moisture.

83. *Lucerne*.—Lucerne is a leguminous fodder crop which is grown extensively in the province by enlightened ryots as cattle feed. It requires a well drained, medium to heavy loamy soil. It gives seven to eight cuttings per annum. There is an annual and a triennial variety of this crop. The plant has a deep root system and is therefore drought resistant. It will bear extremes of heat and cold. Chemical analysis shows that lucerne contains 16.3 per cent of digestible protein and 55.9 per cent of total digestible nutrient and has 37.7 db. of starch equivalent. It has 1.7 to 2.8 per cent of CaO and 0.79 to 0.74 per cent of P₂O₅. Lucerne is well known for its vitamin content. When properly developed, it is an excellent fodder crop having a high percentage of protein of the highest quality. It is rich in calcium. It can also be grown as a dry crop, on account of its deep rooting habit. Several varieties of lucerne suited to different localities are available. It is preferable to use inoculated seeds for sowing.

84. *Lucerne hay*.—Due to its richness both in protein and mineral matter, especially lime and also because of its palatability to all classes of stock and its beneficial laxative effect, lucerne hay is the best amongst the roughages. It is highly esteemed for feeding dairy cows which need an abundance of protein and lime for milk production. But cattle fed on green lucerne are subject to bloat.

85. *Cowpeas*.—Cowpeas is best sown early with cholam or alone. When irrigated, green fodder of 12 to 16 thousand pounds per acre may be obtained. Even under adverse conditions, the crop becomes ready for feeding within two months.

86. *Redgram*.—It has been recorded that redgram is a legume whose leaves are rich fodder, and that it will stand cutting four to six times a year. It is also perennial and can stand on the soil for four or five years without its stem becoming woody. Its roots go deep enough to resist drought. The fodder possibilities of this plant deserves serious study. If found suitable, this fodder plant deserves introduction in the drier districts of our State.

87. *Suggestions for the future*.—Steps must be taken to increase the area under lucerne, Pillipesara and sunnhemp especially within economic distances of urban centres where there will be good demand for lucerne both for milch cattle and for ponies. Nothing more than propaganda is indicated at this stage.

88. *Grasses*.—A fairly exhaustive list of fodder grasses of our State will be found in Appendix II. Here it is proposed to give some information regarding grasses in general to stress the importance of providing grazing for the cattle. In the March 1937 issue of "Indian Journal of Veterinary Science and Animal Husbandry" Mr. Fraser has written that an animal should be bred as nearly as possible on its natural food and that it was highly probable that there may be undiscovered food factors in natural foods such as grass. The presence of a property in growing grass which has an influence on the defensive mechanism of the animals' tissue has been suggested. Graziers who have been handling Ongoles for generations have given out as their experience that grazing benefits the animals more than feeding the same grass, as cut fodder. When grazing, the animals get more tips of blades of grass at every bit and research has proved that these tips of grasses are rich in nutrients and growth producing auxines. This accounts for the superiority of grazing over stall feeding. The young grasses contain more vitamin, more calcium and more phosphorous than the mature ones. Grass is an important supplier of protein to the animals and its protein content can be kept high, by frequent cuttings during its period of growth. Pasture reflects the mineral deficiencies of the soil remarkably well. A survey of the mineral contents of grasses of South Indian pasture lands was done by Sri P. V. Ramiah, formerly Government Agricultural Chemist, Coimbatore, and the results have been published in Indian Farming of December 1941. The results of the survey and chemical analysis are dealt with in the next paragraph.

89. *Chemical survey of mineral deficiencies in the pastures of South India*.—It was noticed that while in the greater part of the State, the grasses showed a good content of both calcium and phosphorus, those of Malabar district were very poor in both the minerals. The northern portions of Salem district had a low calcium content in its grasses, while in Kurnool and in parts of Anantapur districts the calcium content was good but the phosphorus content was very low. The districts of the East Coast had natural pastures of high nutritive value as also the Coimbatore district in the south. The area of deficient minerals was, therefore, the Malabar district, while the northern portions of Salem district, whole of Kurnool district, and portions of Anantapur were ill-balanced tracts containing good calcium but a low phosphorus content.

In the deficiency areas of Malabar the cattle are generally short in stature and poor in condition. Good cows introduced there, rapidly deteriorate in milk yield and in general condition. In Kurnool district though the cattle are generally in good condition, in some taluks they suffer from Rheumatic Arthritides locally known as *Vayupottu* or *Vayu noppulu* which cripples the animal. This disease is traced to the adverse ratio between calcium and phosphorus in those places. Further work revealed the presence

of fluorine in the water obtained from wells of that locality. Fluorine affects the absorption of phosphorus into the animal body and its presence aggravates the effects of a poor supply of phosphorus in the food.

90. *Prevention and cure of mineral diseases*.—If the water is freed of fluorine and the animals are treated to a mineral mixture along with their feed these mineral deficiencies will be corrected and the diseases will disappear. Mineral mixture usually contains equal parts of burnt-shell lime and steamed bone meal, ground into fine powder. As the mixture has a smell, and not quite relished by cattle, it is usually mixed with concentrates and given to the animal, the dosage being one or two ounces of mixture depending on the age and nature of the animal.

91. *Necessity for a detailed survey of nutritional deficiency*.—A more detailed survey of the nutritional deficiencies of the different tracts of the State is necessary so that early steps may be taken to correct the same. This has an important bearing on the oestrus cycle, sterility and health of the progeny of the animals. Until recently reproductive troubles in animals were considered to be due to diseases, but research has shown that in many cases it is due to faulty nutrition principally due to deficiency of vitamins and minerals. A cow in gestation requires extra quantities of A and E vitamins and these can be supplied from green leafy feed. Dr. K. C. Sen has recorded (Agriculture and Livestock in India, November 1932) that deficiency of lime or phosphorous or both may lead to either sterility or abortion in the female. Lime deficiency is very common in stall-fed animals, which get in their feed, a high proportion of concentrates which lack lime. One of the commonest symptoms of this lime deficiency is the tendency of the animals to eat earth and mud. Dr. K. C. Sen has also recorded that phosphorus affects the fertility of domestic animals. Deficiency of phosphorus in a pasture induces the disease called *phosphorous*. As a result of this disease the animals get emaciated, develop depraved appetite such as chewing of bones and carcass or refuse matters, become prone to infectious diseases and get partially or completely sterile. It has been mentioned very early in this report that by increasing the feed of the animal, it will be possible to reduce the oestrus cycle and that there may not be any necessity then to keep such a large stock of useless cows. True, but the feeding must be balanced and designed to make up for the mineral deficiency in the pasture, otherwise sterility, abortions and high death-rate amongst calves will still force us to keep a very large stock. Luckily, mineral deficiencies in the feed can be corrected very easily and at cheap rates.

92. *Some important grasses and their nutritional properties*.—*Cymbodon Dactylon*.—*Harada grass*, *Aragada pillu* (Tamil).—It is an aggressive, creeping grass, which is highly nutritious. It

100. *Spear grass (Heteropogon contortus)*.—Spear grass appears almost universally and is a very important grass of the State. It is very hardy, deep rooted and tillers freely. It is very drought resistant. In Nallamalais, near Chelama, this grass was easily between 5 feet to 6 feet in height in January of this year. Mr. P. V. Ramiah formerly Agricultural Chemist at Coimbatore has done considerable work on this important grass of our State and his figures show that the grass gives the best analysis for protein only when it is in full flower. This can be made out from the following figures:—

		Calcium CaO.	Phosphate P ₂ O ₅ .	Potash K ₂ O.	Protein.	Remarks.
October		0.402	0.431	1.438	6.39	Heavy rain.
November		0.377	0.528	1.395	9.07	In full flower.
December		0.420	0.439	1.281	4.84	

This high protein content is misleading because most of it is indigestible. Doctor Sen has worked out the quantities of digestible protein in spear grass and this is given below:—

	Digestible protein. PER CENT.
Bangalore spear grass hay in flower ..	0.89
Bangalore spear grass hay in seed ..	0.00
Hosur spear grass hay in young ..	2.93
Hosur spear grass hay in prime	0.84
Hosur spear grass hay in ripe	0.00
Bombay spear grass hay in early ..	2.47
Bombay spear grass hay in before flower.	1.86
Bombay spear grass hay in flower ..	0.59
Bombay spear grass ay in seed	0.00

The importance of digestibility trials is stressed by the above figures because one is likely to be misled by the high protein content whereas practically the whole of it might be indigestible. Spear grass is a case in point. At the time when it is normally cut, the digestible protein content of spear grass is negligible. It is better to harvest spear grass early when its protein is fairly good.

101. *Panicum antidotale* (The Australian drought resisting grass).—This is a quick growing and extremely drought resisting grass which has done well in all the Agricultural Research Stations where it was tried. The plants when young are readily grazed, but when allowed to stand long, the culms become woody and less palatable. This grass, on account of its extreme drought resisting quality has a great potentiality. But before any large-scale introduction of this species is attempted it is suggested, that palatability and digestibility tests be conducted with this species at various stages of growth so as to assess its real value.

102. *Chengali gaddi (Isilemia antheophoroides)*.—Chengali gaddi is one of the important pasture grasses of the Ongole tract. On it thrives the famous Ongole breed of cattle. Its chemical analysis is given below:—

	Moisture.	Soluble mineral matters.	Insoluble mine- ral matters.	Fat.	Woody fibre.	Crude proteins.	Carbo hydrates.	Albuminoids.
	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	
Chengali- gaddi.	7.23	3.08	8.00	1.99	32.17	4.26	43.27	100 3.48

It is an excellent pasture grass.

103. *Nendra (Sehima nervosum)*.—Nendra is another important pasture grass of the forest areas. It is eaten with relish by the cattle. Its chemical analysis is as follows:—

	Moisture.	Soluble mineral matters.	Insoluble mine- ral matters.	Fat.	Woody fibre.	Crude proteins.	Carbo hydrates.	Total.	Albuminoids.
	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.		
Nendra ..	6.87	2.08	16.71	1.47	32.04	2.93	37.90	100	2.57

104. *Tree leaves as fodder*.—Tree leaves can be utilized as famine fodder. In fact trees have been lopped in the past in seasons of scarcity for feeding the cattle. It is suggested that in the fuel and fodder plantation, proposed to be raised in the poramboke only such trees as have both fuel and fodder value may be raised. Further in other localities, like road margins, canal banks and in places which are not suited for concentrated methods of planting, trees whose leaves yield fodder may be raised. A start in this direction may be made in the Anantapur and Bellary districts, especially in those taluks which are susceptible to famine. A fairly exhaustive list of the common fodder yielding trees of the province is given in Appendix III. There are many species found in that list, which can be easily propagated by cuttings or seeds. Drive in this direction will bear fruit and it is also necessary especially in the famine areas.

105. *Chemical composition of tree leaves*.—All tree leaves irrespective of time of lopping have a high crude protein content. In some cases they are even comparable to Berseem and lucerne. Also the calcium—phosphorous ratio is high in leaf fodder varying from 8:1 to 16:1. The phosphate content was also found to be

high in majority of the cases, when compared with that of commonly used green fodders. The protein, CaO and P₂O₅ values of a few trees are given below :—

Species.	Common name.	Crude protein.	CaO.	P ₂ O ₅ .
<i>Adina cordifolia</i> ..	Manja Kadambai ..	15.26	2.41	0.26
<i>Bauhinia Variegata</i> ..	Mandarai ..	13.15	3.50	0.04
<i>Azadirachta indica</i> ..	Neem ..	15.31	5.53	0.48
<i>Ficus religiosa</i> ..	Peepul ..	12.68	4.58	0.47
<i>Ficus infectoria</i> ..	Kal alai ..	10.90	2.92	0.45
<i>Zizyphus jujuba</i> ..	Ilandai ..	12.8	4.23	0.76
<i>Dalbergia sissoo</i> ..	Shisham ..	16.25	4.73	0.54
<i>Acacia catechu</i> ..	Sundra ..	11.81	4.65	0.19
<i>Hardwickia binata</i> ..	Yepi ..	10.79	4.10	0.24

The list is by no means complete, it is suggested that the chemical composition of the leaves of the more important fodder yielding trees may be determined, and their digestible nutrients worked out, to have a correct idea of their real value.

106. *Feeding experiments on some fodder leaves.*—The Indian Veterinary Research Institute has conducted, feeding experiments with leaves of 'Pipal' (*Ficus religiosa*), Banyan tree (*Ficus bengalensis*), *Ficus infectoria*, *Ficus glomerata*, and *Zizyphus jujuba*. Their tests indicated that Banyan leaves cannot be given as sole feed. The animals recorded positive balances for calcium but negative balances for both nitrogen and phosphorus. The digestibility co-efficients of crude protein, ether extract, crude fibre and nitrogen free extract were found to be 21, 29, 26, and 65 respectively. The figures for digestible crude protein and total digestible nutrients compare favourably with corresponding figures for such grass hays as *Cenchrus ciliaris* and are better than those for cholam and spear grass hay. Pipal leaves formed good maintenance ration both for *kumoni* bullocks and goats whether given as a single feed or together with supplementary. In all experiments with pipal, animals recorded gain in live-weights and positive balances for nitrogen, calcium and phosphorus. Digestibility coefficients were found to be for crude protein 57, ether extract 23, crude fibre 29, nitrogen free extract, 53. The experiments revealed that pipal leaves may form a maintenance ration for cattle and goats when given as a single feed and also that they may serve the purpose of a concentrate to some extent when given in combination with some other roughage. *Ficus infectoria* leaves were found to maintain the animals at all the stages and provide fairly good amount of digestible crude protein at the young and mature stage. As regards energy value, tree leaves are comparable to grasses like spear grass, Rhodes grass and cholam but with the advance in maturity the energy value had decreased considerably. In the case of '*Ficus glomerata*' it was observed that the digestible crude protein figure was fairly high and quite comparable to that of pipal and '*Ficus infectoria*'. The starch equivalent was higher in this case than those of pipal and '*Ficus infectoria*' leaves.

In the case of (Ilandai) or *Zizyphus jujuba* both the digestible crude protein and starch equivalent figures were much less as compared with those of pipal and *Ficus infectoria*. The above observations on a limited number of trees reveal that leaves in general, contain a fair amount of digestible crude protein, but in energy value they are only comparable to coarse fodders such as hays and cereal straws. The distribution of nutrients suggests that the leaves can be used as a ration both as a concentrate and a roughage and this fact may conveniently be used in feeding cattle and goats in times of famine or general scarcity of feeding stuffs. Further work on digestibility trials with leaves of fodder plants is indicated.

107. *Trees on private lands.*—In dry lands of Karur, Dhara-puram and Palani taluks it is customary to leave a fair number of *Acacia leucophlœa* and other trees well distributed in each holding. Steps must be taken to spread this good habit to all the districts of the State. The beneficial effect of having these few trees in each holding will be apparent in a few years. It will solve many problems and what is more the pods of *Acacia leucophlœa* are good feed to cattle. Trees having a light shade and whose leaves and seeds are cattle feed should be preferred. Growing of Jamun (*Syzygium jambolanum*) trees in places, where it will not affect cultivation should be considered as the seeds are a fairly rich source of protein and calcium and considered suitable for feeding livestock.

108. *Emergency fodder in famine areas.*—The Indian Veterinary Research Institute has suggested a few grasses and other feeding stuffs which are not commonly used, but which can form reasonably satisfactory substitutes in times of scarcity. In this connexion Jamun seeds have been suggested, as also mango kernels. Leaves shed in autumn by *Ficus* species and *Zizyphus* and other fodder trees can replace the roughage requirement. The institute has also suggested the utilizing of sugar factory products like screenings of bagasse and molasses, in preparing bagomolasses in a compressed cake form for distribution as cattle feed in famine areas. This bagomolasses was made by the Sugar Technology Institute at Cawnpore and it was systematically tried for feeding dairy cows at the Dairy Institute, Bangalore, and found to be quite a useful feed. The institute states that this feed can be made at almost all the sugar factories in India. It is suggested that steps may be taken in this State in collaboration with the sugar mills to have an emergency stock of bagomolasses always ready for rushing to scarcity areas, in times of need.

109. *Molasses.*—Work was done on molasses, a by-product in the manufacture of sugar, as a feed for livestock. Analysis showed that it contained 70.09 per cent of soluble carbohydrates and 0.6 per cent of protein. From the feeding trials made, it was concluded that 2 lb. of molasses could replace 2 lb. of maize as a concentrate for working bullocks. In the case of cows 1 lb. of molasses was used in replacement of 1 lb. of bran. There was no

appreciable change in the milk yields of the cows. The protein deficiency in molasses was made up by supplementary feed. Experiments also revealed that the feeding of molasses to cattle during the summer months was not advisable.

110. *Nutritive value of feeds.*—Valuable work has been done by many research workers on the nutritive value of feeding materials and these are given below. The idea in giving these figures and in writing the preceding paragraphs relating to the cattle feed of this State is to give a correct idea of the relative value of the different feeds and to dispel some common fallacies about the superiority or otherwise of some popular feeds. The table is taken from Sri S. C. Das Gupta's book on "Cow in India". The figures were adopted by him from Dr. Sen's tables.

Digestible nutrients per 100 lb. of dry material.						
Name.	Crude protein.	Nutrition ratio.	Starch equivalent.	Lime.	Phosphates.	Potassium.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Green feeds —						
Cumbu	4.31	12.9	47.9	0.56	0.44	2.96
Berseem	12.56	3.8	43.4	2.69	0.61	3.4
Elephant grass	3.85	13.4	38.4	0.79	0.61	2.99
Guinea grass	5.83	10.2	42.3	0.71	0.90	3.78
Cholam young	4.20	12.4	35.8	0.69	0.41	2.45
Do. primo	3.44	14.7	35.2	0.59	0.32	1.67
Do. ripe	1.16	45.0	30.8	0.63	0.25	1.76
Lucerne	16.19	2.7	41.4	3.64	1.12	4.93
Maize	4.68	13.5	52.6	0.71	0.63	1.61
Sudan grass	1.57	27.2	28.4	1.19	1.33	1.99
Sun flower	8.55	5.1	37.6	..	..	..
Hays —						
Hariali hay	8.09	5.7	38.7	0.70	0.44	1.53
Guinea grass (before flower).	4.09	10.6	24.8	..	..	..
Cholam young	2.81	17.3	27.5	0.38	0.54	3.49
Do. primo	1.78	27.7	28.4	0.38	0.33	1.67
Do. ripe	0.64	79.8	27.0	0.32	0.56	1.90
Kolukattai —						
Young	11.17	4.3	42.1	..	..	..
Prime	5.49	9.2	35.2	..	..	..
Ripe	2.97	16.8	33.2	..	..	..
Spear grass —						
Prime	0.84	52.4	23.2	..	..	..
Ripe	0.00	..	28.4	..	..	..
Early	2.47	19.5	30.9	0.47	0.30	1.41
Sugarcane leaves	0.00	..	24.6	0.55	0.14	1.00
Legume hays —						
Berseem	10.29	5.4	47.3	2.07	0.65	3.89
Cowpea	10.33	3.9	29.6	2.27	0.40	2.89
Groundnut	14.93	2.3	33.8	2.65	0.58	3.26
Lucerne	16.37	2.4	37.7	..	..	..
Straws —						
Gram bhoosa	2.41	14.4	11.2	0.47	0.27	2.01
Ragi straw	0.23	..	34.7	1.11	0.16	1.5
Rice straw	0.00	..	30.1	0.5	0.15	1.63

Digestible nutrients per 100 lb. of dry material.						
Name	Crude protein.	Nutrition ratio.	Starch equivalent.	Lime.	Phosphates.	Potassium.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Concentrate grains —						
Cotton seed	12.49	6.1	85.5	..	..	..
Gram	14.33	4.7	78.5	0.33	0.95	0.72
Maize	8.22	10.5	93.3	0.02	0.94	..
Concentrated cake —						
Cocunut	21.10	3.3	90.0	0.56	1.09	..
Cotton seed cake	19.42	3.1	67.1	0.39	2.95	..
Groundnut cake	64.29	0.7	75.9	0.28	1.28	1.43
Gingelly cake	42.60	1.0	83.3	..	..	..
By-products —						
Gram husk	0.00	..	47.0	..	..	..
Wheat bran	11.80	5.4	58.9	0.25	1.98	1.46
Rice bran	6.76	8.5	48.3	0.22	6.33	0.19
Grasses.						
(1)	Protein.	Fat.	Carbohydrates.			
(1)	(2)	(3)	(4)			
Chengali	4.26	1.99	43.27			
Eremopogon	3.39	1.66	42.94			
Apluda aristata	4.41	2.52	35.84			
Chrysopogon orientalis	4.45	1.13	42.64			
Botha	2.27	2.62	44.36			
Nendra	2.93	1.47	37.90			
Nakka peethu Kesavu (Perotis indica).	4.03	1.87	49.41			
Melanocenchrus monica	4.63	1.37	47.00			
Chipuru gaddi (Aristida setacea).	3.32	1.14	43.86			
Enteropogon Monostachyos	4.33	1.41	44.34			
Chrysopogon montanus	2.83	1.51	45.37			
Eragrostis bifaria (Poovala gaddi).	2.50	1.77	43.95			

CHAPTER VII.

SURVEY OF FODDER POSITION AND SUGGESTIONS FOR IMPROVEMENT.

111. *Fodder production in the State and its distribution amongst the various crops.*—In the year 1944-45 the year in which the live-stock census were taken, the net area under cultivation was 31,533,823 acres which was 39.5 per cent of the total area of the State. Of the area thus cultivated 9,482,674 acres were irrigated. Including double crop lands the total area under cultivation came to 36,999,372 acres and out of this 11,721,973 acres were

irrigated. Out of this nearly 37 million acres food crops occupied about 28 million acres, i.e., nearly 75.6 per cent. Their distribution is given below :—

Food crops.

<i>Name and nature of the crop.</i>	<i>Extent in acres.</i>
Paddy (irrigated and unirrigated) ..	11,013,530
Cholam (do.) ..	4,645,257
Cumbu (do.) ..	2,442,320
Ragi (do.) ..	1,677,049
Korra	1,474,606
Varagu	897,030
Samai	553,902
Maize	51,846
Other cereals	548,959
Greengram	491,880
Redgram	332,446
Blackgram	306,940
Bengulgram	7,539
Horsegram	1,550,353
Other pulses	244,487
Chillies	285,122
Other condiments and spices ..	328,809
Sugarcane	240,715
Total fruits and vegetables including root crops.	746,009
Miscellaneous food crops	57,398
Total food crops ..	27,968,197

Non-food crops.

	<i>Normal.</i>	<i>1944-45.</i>
	<i>A.C.S.</i>	<i>ACS.</i>
Groundnut	3,695,410	4,299,592
Gingelly	762,580	616,142
Castor	257,470	284,759
Coconut	594,660	615,518
Other oil seeds	65,440	90,435
Fodder crop	452,710	459,653
Total, non-food crop ..	..	9,031,175
Area sown more than once ..	..	5,465,549

112. A brief survey of the fodder crops grown in the State.—In the Visakhapatnam district fodder crops as such are not grown. The straws of paddy, ragi and cumbu and to a lesser extent

cholam, korra, samai, etc., crops are used as fodder. All crops except paddy are sown early in the season and if early rainfall advances the date of sowing of paddy, the standing crops are sometimes cut when they are in flower for fodder and the area got ready for raising paddy. Leguminous crops like blackgram, greengram, horsegram and groundnut are grown for seed and their haulms and bhuss are fed to the cattle. Pillipesara is becoming popular in paddy lands both as a green manure crop as well as a fodder crop. In areas where sugarcane is grown, the green, cane-tops after the harvest of the canes are used as fodder. In some areas where desi gogu (Gongura) is grown, gogu leaf is used as special fodder for work cattle. Near large urban centres maize is grown in small areas for cobs and after the harvest of the grain, the stalks are fed to the cattle.

In the delta portions of Godavari and Krishna and Guntur districts, Pillipesara (*Phaseolus trilobus*) is extensively grown as green fodder as well as green manure, while Sunnhemp, another fodder crop which is also grown, is usually made into hay and stacked in alternate layers with paddy straw. Sunnhemp and Pillipesara are sown broadcast in the standing crop of paddy, a week or ten days before its harvest, in November and December. After the paddy crop is harvested, the fodder crop comes up with the existing moisture in the soil. Sunnhemp being a short-duration crop is harvested in February–March, while Pillipesara is allowed to remain in the field till April and May. During this period the Pillipesara crop is cut for fodder two or three times. What remains is ploughed in as green manure. In the dry lands of these districts cholam, either pure or mixed with Pillipesara, is grown as a fodder crop in the mungari season and as a grain crop in the late season. Korra and variga are also grown for grain and their straws are used as fodder. In recent years in the dry lands of these districts the area under commercial crops like groundnut, chillies and tobacco has extended at the expense of food and fodder crops. The ryot is thus becoming increasingly dependent on the delta for his food and fodder. Pasture lands (bidus) which were once very common, especially in Guntur district, have mostly been ploughed up. In the Ceded districts, jonna straw is the main cattle fodder, while tenai straw comes next. Leguminous crop residues are in short supply in the Ceded districts, because pulses which are usually grown in mixture with cereal are more suited to the tilling practice of red soil areas and not to the black soils. In black soils such a mixed crop is not raised, because it will be at the expense of the cereal crop. Groundnut and horsegram are, however, grown in many parts of the Ceded districts and their haulms and bhussas form fodder for animals. Where irrigation facilities exist, paddy, ragi, etc., are cultivated and their straws form the fodder. In areas where sugarcane is cultivated their tops are fed to cattle. Apart from this no regular fodder crops are grown in these districts to any appreciable extent. In Nellore, Chingleput and Chittoor districts, the straws of paddy, cholam and ragi form the chief fodder. Cholam is sown

in dry lands mixed with pulses like blackgram, greengram and lab-lab whose haulms and blusas form cattle feed. Groundnut and horsegram haulms and straws of minor cereals like tenai and varagu are also available to some extent. No regular fodder crops are sown in these districts also. In Nellore district, however, though special fodder crops as such are not raised, yet some private-owned pasture lands, called kanchas, exist. In North Arcot, Salem, Coimbatore, and parts of South Arcot and Chittoor districts, where intensive garden land cultivation is practised, cholam is grown as a fodder crop on a limited scale both in garden lands and in dry lands. Cereal straws like paddy, cholam, cumbu, ragi, etc., form the important source of fodder. Cholam and cumbu are generally raised as mixtures with pulse crops like lab-lab, blackgram and greengram. The haulms and blusas of these pulse crops also contribute to the total fodder supply. Groundnut is grown extensively in this tract and the haulms of this crop are also available for the cattle. Near Coimbatore town, Lucerne is regularly grown and sold as fodder for the milch cattle and horses of the town. Agathi is raised in small areas round about Vellore and sold regularly in the town as fodder for the milch cows. In Tanjore and parts of Tiruchirappalli and South Arcot districts, paddy straw is the principal fodder for the cattle. Pulses like blackgram and greengram are grown in wet lands after the harvest of paddy in December and January and the residue of these crops is utilized as cattle fodder. Pillipesara as a green-manure crop has been raised in the wet lands after paddy in the eastern parts of Tanjore. In Tiruchirappalli town, Agathi and Kalyana muruku (*Erythrina indica*) leaves are sold as fodder for milch cattle. In the dry areas of these districts cholam and cumbu are sown mixed with pulses like lab-lab, greengram and naripayar (*Phaseolus acutifolius*). The straws and the haulms of these crops are also used as fodder. In the black soils of Madurai, Ramanathapuram and Tirunelveli districts the ryots usually reserve a portion of land for growing rainfed cholam as a pure fodder crop using a very high seed rate to get the stalks thin and fine. On the red soils, however, cholam is a grain crop. Here it is often mixed with pulses like lab-lab, greengram, blackgram, etc., if rainfed, and grown pure under irrigation. The crop residue of all these crops, forms the fodder for cattle. Fodder crops as such are little known in the West Coast. Paddy straw is the main cattle feed. Pulses like greengram, blackgram and horsegram are grown in dry lands as well as in some paddy land and their haulms and blusas are fed to cattle. There is plenty of grazing available during the monsoon from June to December and January. In Nilgiris, the straws from samai, barley, wheat and koral are used as cattle fodder, but the principal fodder for the cattle of the Nilgiris is the natural pasture of the downs which occur there. Some of the local bodies like, Madurai, Golden Rock Railway Colony, Mettur, Visakhapatnam, Rajahmundry, grow perennial fodder grasses like Guinea and Napier grasses either with sewage or sullage water. Of these, the largest is the Madurai

Municipal Sewage Farm which is about 110 acres in extent. These special fodder grasses have a great demand, as they are grown near important urban centres.

113. *An examination of the position.*—Fodder crop as such is grown only over about 4-6 lakhs of acres in the State. This, needless to say, is a very poor contribution to the fodder supply of the State. That the majority of cattle depend only on the straws, haulms and blusas of the crops which are grown in the State, will be clear from the previous paragraph, in which a brief survey has been made of the availability of fodder. According to the Memoir published by the Madras Fodder and Grazing Committee, out of a total fodder production from all sources of about 33.75 million tons, dry roughages, which is practically wholly obtained from food crop residues accounted for 21.19 million tons. Even 33.75 million tons represent only 4.91 lb. per day per cow unit. Therefore the contribution made by the crop residues to the cattle fodder supply of the State is very little indeed. To improve the fodder supply the total quantity of crop residue produced, should be increased considerably. The crop residue will increase only if the foodcrop production increase. The foodcrop cultivation has already extended to marginal and sub-marginal lands and so any increase in production of food can be achieved only by adopting intensive methods of cultivation in the existing lands. Even by adopting intensive methods of cultivation, it may not be possible to produce sufficient quantity of crop residue for all the cattle of our State. Fodder will have to be grown as a pure crop to bridge the gap between demand and the supply. To sum up, the following are the lines in which an approach may be made to increase the fodder supply from private lands:—

- (1) adoption of scientific and intensive methods of cultivation to increase the grain outturn and incidentally increase the quantity of crop residue;
- (2) inclusion of a regular fodder crop in the cropping cycle; and
- (3) growing a pure fodder crop in a portion of the individual's holding.

It will be better if such fodder crops are also green manures.

114. *Scientific and intensive methods of cultivation.*—It is not proposed to give here the details of the various methods, which have been evolved by research to improve the present methods of cultivation and to increase the production of the crops, as it is beyond the scope of this report. But generally speaking by adopting soil and water conservation measures, by improving the texture and composition of the soil mechanically and chemically, by using improved strains of seeds, by supplying judiciously increased quantities of manure, by using strains which will have increased and more palatable crop residues, by proper spacing of plants, by taking steps to minimise loss of crops due to insect and fungus attacks, it will be possible to increase the present outturn of grains and crop residue.

It will be also possible to increase the crop yields by irrigation. But provision of such sources of irrigation will be costly and will not cover all the cultivated area. The fundamental idea is that, what is taken out of the soil in the shape of grain and crop residue must not only be returned to the soil, but something more should be given and the soil fertility improved. If this principle is adopted, there will be increasing returns from the soil. Science has advanced so much as to give an exact idea of the loss of soil nutrient involved in growing the different crops and so manuring can be so regulated as to make good at least this loss. It will be very difficult to guess the exact increase in yield which will be obtained as a result of adopting scientific and intensive methods of cultivation. In Hagari Farm by using improved strains of sorghum like H. 1 and M. 47-3 a 15 per cent increase in yield was obtained. Similarly in the case of *Setaria* the increase in the yield was 15 per cent. In the case of ragi a 10 per cent increase in yield was realized. Hagari experiments have also revealed that in contour-bunded fields of ryots, with a sorghum crop, a 12 per cent increase in grain yield and 93 per cent increase in straw yield were obtained, over the non-bunded control area. All factors put together, it may not be possible to expect more than a 25 per cent average increase in the crop yields, as a result of adopting improvements in our cultural practices. But it must be stated here that the full possibilities of manuring have not been studied, especially under mixed farming conditions. All the same, the fodder problem cannot be solved by merely intensifying our methods of cultivation with the existing cropping practice.

115. *Possibility of including a fodder crop in the existing crop rotation and the necessity for the same.*—The possibility of including a fodder crop in the existing crop rotation was studied by us. We had also discussions with officers of the concerned districts. It will be possible in our opinion to increase the fodder production in the State by growing green manure-cum-fodder crops after the paddy crop in many of the districts where wet cultivation is practised. In black-cotton areas, where money crops like cotton and tobacco are grown, the present practice of growing food crop, mostly jonna, in alternate years may have to be changed, so that once in three years only money crop may be raised. This is because with the existing crop practice the districts do not produce sufficient fodder. In the Krishna and Godavari deltas the ordinary practice is to grow Sunnhemp and Pillipesara after the principal rice crop. With all this the cattle of that tract are in poor condition. Some say this is due to the seasonal migration of cattle to the uplands, as there will not be even standing space to the cattle when the paddy crop is on the field. But on this point the opinion is divided as good grazing is available in the uplands. Statistics show that where wet cultivation is practised, on the average one animal is maintained for each acre of cultivated area. One acre under paddy may yield on an average about 1,750 lb. of straw. This quantity

will hardly sustain an animal for a year. Further, as already mentioned, as a feed, paddy straw is poor in quality on account of its excess potassium content and the presence of insoluble oxalates. This is also another reason for the poor condition of the cattle of rice tracts. The same phenomenon is observed in all the rice tracts of the State. The paddy straw produced is neither good in quality nor sufficient in quantity. Sufficient dosage of common salt in the feed might overcome the defects in quality, but for making up the short supply, more serious steps may have to be taken.

116. *Fodder position in South Arcot.*—South Arcot is a district of very poor cattle. In a cattle shandy which was held near Mailam there were small pairs of cattle which could be purchased for about Rs. 75. The ryots seem to be satisfied with growing money crops both under irrigated and under rainfed conditions to the maximum extent possible. The cattle population of the district, their requirements of fodder and the actual fodder produced were all worked out to have an idea of the fodder position of the district. The cattle population of the district, assuming that young stock are half adults, comes to 1,113,162 animals. Assuming a ration of 13½ lb. per head per day about 2.5 million tons of fodder will be required per annum. Assuming that for 60 days in the year the cattle can manage with sources of fodder other than crop residue, the net quantity of crop residue required will be about 2.1 million tons. Approximately the following quantity of crop residue may be expected from the different crops:—

	TONS.
Paddy straw from 571,000 acres at 1 ton per acre	571,000
Groundnut haulms from 387,000 acres at ½ a ton per acre	193,500
Cholam straw from 92,140 acres at 1/8th ton per acre	11,518
Varagu straw from 163,000 acres at 1/8th ton per acre	20,375
Ragi 104,000 acres at 1/8th ton per acre	13,000
Total	809,393
or say 8 lakhs of tons.	

So the deficit comes to 1.7 million tons of fodder per annum. The possibility of growing a fodder crop in the present cropping rotation was then considered. The following was considered possible:—

ACS.

Dry lands.

- 1 Sunnhemp can be grown in July over 50 percent of the early sown groundnut area. This will come to about. 50,000

ACS.

Garden lands.

- 2 Sunnhemp can be grown in garden lands before a crop of sugarcane is raised in Cuddalore and in parts of Villupuram taluks. This will come to about. 10,000

Wet lands.

Single crop—

In Chidambaram, Vriddhachalam, and Cuddalore taluks and parts of Villupuram and Tirukkoyilur taluks along the banks of Pennar, in the project areas out of a total of 1.75 lakhs acres, Sunnhemp and Pillipesara may be grown over about. 40,000

In double-crop wet lands in Chidambaram taluk Sunnhemp can be grown after the harvest of late samba paddy over about. 10,000

Total .. 110,000

Even assuming a fodder yield of $1\frac{1}{2}$ tons per acre the extra production will come to only 172,500 tons per annum. Still there will be deficit of 1.7 million tons minus 0.172 million tons, i.e., 1.5 million tons. This deficit can be made up by growing pure fodder crops over about 500,000 acres, assuming on the average an yield of dry fodder of 3 tons to the acre. This is 31.2 per cent of the area cultivated in 1944-45. The above figures were worked out in consultation with the Superintendent of the Agricultural Research Station, Tindivanam, and the District Agricultural Officer of South Arcot.

117. *Yield from fodder crops grown in South Arcot.*—In the Agricultural Research Station at Tindivanam fodder crops were raised both under rainfed conditions and under irrigated conditions. The yield figures are given below :—

Name of fodder.	Acre yield in lb.	
	Maximum.	Average.
<i>A. Rainfed.</i>		
Thin Napier grass	..	11,465
Do.	..	16,630
Napier grass	..	21,580
Guinea grass	..	12,540
Cholam	18,930	15,075
Pillipesara	24,380	14,160
<i>B. Irrigated.</i>		
Napier grass	58,470	22,350
Guinea grass	32,200	20,940
Lucerne	30,460	12,925
Berseem	20,190	18,900

118. *Position in other districts and the future possibilities.*—

In other districts of the State also the fodder position will be similar to that of South Arcot if not worse. Certain amount of improvement can no doubt be obtained by introducing a green manure cum fodder crop in the existing cropping rotation. But a real and lasting solution can be achieved only if the ryots take to growing a pure fodder crop in their fields. We are lucky in being able to grow in the State green manure cum fodder plants like Sunnhemp and Pillipesara and if these are grown, there may not be any need to devote 5/7th of the area to fodder and 2/7th to paddy as at Revenna in Italy. South Arcot figures indicate that if a pure fodder crop is grown over about 30 per cent of the cultivated area it will be enough to meet the demand of that district. If mixed farming methods are adopted and the cropping conditions improve, the yields will progressively increase and there may not be any necessity to devote even 30 per cent of the area to a fodder crop. If experience elsewhere is to be credited, the total yield of food-crop also will not go down but improve, by devoting a proportion of the area to raising fodder for the cattle and thus making a 'bio-dynamic' approach to the fodder problem possible.

119. *Experience gathered in Hagari Research Farm.*—Hagari Research Farm maintains 36 animals, out of which 15 are work animals. The balance of 21 animals include 4 cross-bred Sindhi cows, 4 she-buffaloes of Murrah breed, one Sindhi and one Murrah breeding bull, the rest being young stock. For feeding this mixed herd containing 25 adult animals and 11 young stock it was found that from 65 acres under rainfed Sorghum and an additional 10 acres of miscellaneous rainfed fodder yielding crops like Setaria and Pillipesara, the straw obtained was only a third of the annual requirement.

To make up the deficit, fodder crops like Sorghum, maize, Sunnhemp and Lucerne besides perennial grasses like Guinea grass and Napier grass are grown over about 20 acres under irrigation. About half an acre is sown once in ten days so that there may be a continuous supply of green fodder. To sum up for feeding these 36 animals of really 30.5 adult animals, crop residue over 75 acres grown under the favourable research farm conditions was not found to be enough and an additional 20 acres had to be devoted to raising fodder for the same under irrigated conditions. This example proves the necessity for growing pure fodder crops for maintaining cattle in thrifty condition in addition to utilizing crop residues.

120. *Fodder position in the Ceded districts.*—In the Ceded districts of our State which are susceptible to frequent droughts there are about 2.4 millions of Bovine population. The total annual output of crop residue from cereals, pulses and groundnut crops comes to 5,050 million lb. This works out to a daily ration of 7.2 lb. per animal assuming that for 65 days in the year the animals will feed on green grass. This ration for the heavier type of animals one sees in the Ceded districts is certainly not sufficient. The work

cattle to a limited extent are looked after better, which means that the other animals are given short rations. In years of drought when crops completely fail these heavy animals undergo much suffering. Ryots are forced to sell these animals to itinerant purchasers at sacrifice prices at those times only to repurchase them later on at very high prices. A reserve stock of fodder will obviate this. At present in the black soil areas the cropping rotation is cotton-jonna or cotton-thenai-jonna. Instead of this if cotton is grown once in three years more of jonna straw will become available for the cattle. This aspect may be borne in mind when crop planning is done.

121. *Tungabhadra Project area.*—While considering the Memoir, the Fodder and Grazing Committee expressed the view that in every project, the needs of the animal population should be given proper weight and that the cultivation of fodder should be promoted to the extent required by a plan of balanced development. Also they have said that pending the institution of a land utilization board all departments dealing with irrigation and other projects should be urged to make special provision for fodder cultivation. With this in view, we calculated the total quantity of fodder likely to be produced in the Tungabhadra Project area, if the cropping rotations which are under experiment are adopted.

122. *Cropping rotations.*—A three-year cropping rotation as well as a four-year cropping rotation are under experiment at Siruguppa.

The details are given below :—

Cropping rotation—Three years.

Year.	Crop.	Season.
First year ..	Groundnut—Redgram ..	July to October.
Second year ..	Jonna	June to October.

After jonna bengalgram is raised in the field from November to February under rainfed conditions.

Third year ..	Cotton	August to March.
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Cropping rotation—Four years.

Year.	Crop.	Season.
First year ..	Groundnut—Redgram ..	July to October (redgram till February).
Second year ..	Jonna (after this crop bengalgram under dry conditions).	June to October.
Third year ..	Green manure followed by wheat.	June to August (green manure) and October to February (wheat).
Fourth year ..	Cotton	August to March.

123. *Yield of fodder under the proposed cropping rotations in Tungabhadra Project area.*—The total ayacut of the Tungabhadra Project area is 200,000 acres. For every 10 acre unit it is assumed that one pair of bullocks, one cow, one buffalo and two calves will be necessary. This means five adult animals assuming two calves to be equal to one adult unit. Therefore the total number of animals which will be necessary for the project area will come to 100,000 animals, i.e., one animal for every 2 acres. Under a three-year cropping rotation the area under each crop will be 64,000 acres. Therefore the total annual fodder production will be as follows :—

Fodder in million lb.

(1) Jonna straw 64,000 acres × 5,000 lb. per acre	320 million lb.
(2) Groundnut crop residue 64,000 × 2,000 lb.	128 million lb.
	448 lb.

For 100,000 animals at 15 lb. of roughage per day the annual requirements will come to $15 \times 365 \times 100,000$ lb. = 547.5 million lb. as against a production of 448 million lb. The deficit is therefore 99.5 million lb. Under a four-year cropping rotations the outturn of fodder will be—

Extent in acres.

Yield in lb.

Jonna straw	48,000	5,000 = 240 million lb.
Groundnut haulms ..	48,000	2,000 = 96 million lb.

Therefore anticipated yield 336 million lb.

Fodder requirement 547.5 million lb. per annum.

Annual deficit .. 211.5 million lb.

According to the above estimates with the proposed three or four-year crop rotation, there will be tremendous fodder deficits. This can be made up only by growing a pure fodder crop over a portion of the project area. It is suggested that this aspect should be borne in mind when finalizing the cropping practice.

124. *Green manure and fodder crops in Tungabhadra Project area.*—(a) *Green manure.*—In the Tungabhadra Project area, some of the green manure crops tried, have fared well when grown between March and May. They are Sunnhemp, Cluster beans, Daincha and *Sesbania speciosa*. Cowpea and Pillipesara came up well when sown in June.

(b) *Fodder crops*.—Various types of fodder crops also were tried with success in the different seasons of the year in the Siruguppa farm. Details are given below :—

Type of fodder.	Sowing season.	Yield in lb. per acre—Wet weight.
Jonna	June to August ..	20,000 to 30,000
Maize	June to October ..	12,000 to 15,000
Lucerne	Throughout the year.	12,000 to 15,000
Guinea grass ..	Do.	15,000 to 20,000
Napier grass ..	Do.	10,000 to 15,000
Berseem	September to October.	8,000 to 10,000
Pillipesara ..	June	8,000 to 10,000
Cowpea	Do.	8,000 to 10,000
Cluster bean ..	March to May ..	6,000 to 18,000
Sunnhemp ..	Do	4,000 to 6,000

Species which have both manure and fodder value can be grown in the project area and this will do lot of good to the soil, because Siruguppa experiments have revealed that the limiting factor in the success of dry crop irrigation is manure. The main deficiency of the soils in the project area is their nitrogen content and the normal manure requirements are 40 lb. of nitrogen per acre for cereals and 60 to 80 lb. per acre for Cambodia cotton. The want of manure is a serious defect in the project area. In our opinion the growing of a green manure *cum* fodder crop in the project area, on as large an extent as is necessary for providing fodder for the cattle of the tract, is the surest and the quickest way of improving the soil to enable it to give the maximum outturn of crop. In other words for making the Tungabhadra Project a success, mixed farming practice has to be adopted.

125. *Possibility of growing green manure and fodder crops in Tanjore old delta*.—In the Tanjore delta Pillipesara and Sunnhemp are not grown extensively as they are in Krishna and Godavari deltas. Before the practice could spread, blackgram came into the field and as it is a very paying crop it has ousted Pillipesara in some localities. But there are immense possibilities of growing Pillipesara, which is also good cattle fodder, from December to April in the paddy lands of the old delta especially in the heavier soils of Kumbakonam, Mayuram, Shiyali, Nannilam, Nagapattinam and portions of Tiruturaipundi taluks. The crop is being grown now on a limited scale and propaganda is essential to extend the practice. It is necessary to feed animals with Pillipesara hay along with the rice straw to counteract the injurious effects of the latter. To have a successful crop of Pillipesara summer showers are necessary. Pillipesara is sown about 10 to 12 days before the harvest of paddy. In single crop lands Pillipesara can be grown successfully. Sunnhemp, another green manure *cum* fodder crop, can also be grown in the Tanjore delta. It is a short duration crop and it is sown exactly like Pillipesara about 10 days prior to the harvest of

the main crop. Practice of growing Sunnhemp should also be extended. Apart from this it has been suggested that *Sesbania grandiflora* can be grown on field bunds. This also may be done wherever possible as its leaves are excellent fodder. The possibility of giving a small quantity of water for the green manure crop, if the summer rains fail may be considered.

126. *Possibility of growing fodder in the Cauvery-Mettur Project area*.—The cattle in the Cauvery-Mettur Project area are not in good condition. The yield of paddy straw is poor and the animals get very little roughage to eat. For the work cattle cotton seed is given and this too is in short supply. As the soils in the project area are very porous, the top soil has yet to be built up by heavy application of farm yard, compost and green manures and then only better yields may be expected. In Tungabhadra Project area, before the project has come into existence, research was initiated and there every one is now thinking in terms of including a green manure crop in the cropping cycle. If this had been done when the Cauvery-Mettur Project area was initiated the present troubles would have been overcome and a much better top soil would have been built up by now, even as it has been done in the agricultural farm at Pattukkottai. The trouble now is that the soil is light and porous and the water let into the canals does not either reach the lower reaches or places farther away from the water head in the beginning of the growing season. On account of this reason the Kuruvai crop is mostly confined to fields near channel heads. The Kuruvai extends only over a tenth of the whole ayacut and even for irrigating this small area, full supply has to be maintained in the main channels. So much water goes to waste and there is much trouble in the lower reaches on account of seepage that it is impossible to grow any crop in the early months. It was understood that on account of the peculiar design of the distribution system it would be rather difficult to confine the Kuruvai to definite blocks to enable other crops being grown elsewhere. These are the difficulties experienced in growing a green manure or any other crop in the 'Kuruvai' season. To enable the fuller use of the project land, to increase the output of fodder in the tract and to hasten the reclamation of the project area as early as possible, the following plan is suggested :—

The whole of the Cauvery-Mettur Project area is to be treated as a single crop paddy area, till the soil is completely formed. This will mean that it will be enough if water is given for the only paddy crop which will be grown from the 15th of August. But water will however be required for raising green manure *cum* fodder crops like Sunnhemp and Pillipesara even from the middle of May. It will be enough if a duty of 100 or even more is maintained. To enable this being done and to facilitate the commanding of any particular portion of the ayacut, the present irrigation system may have to be altered. As a result of adopting this idea, there will be a drop in the paddy field equal to the outturn of Thaladi crop on the lands

in which Kuruvai crop was raised. This will amount to 20,000 × 750 lb., i.e., about 6,700 tons. As against this the national gain is that instead of only 20,000 acres, the whole ayacut of 200,000 acres will become available for growing green manure *cum* fodder crop like Sunnhemp and Pillipesara and for growing maize, ragi, cumbu and groundnut which do not require so much of water as Kuruvai paddy, and consequently there will not be much of a seepage trouble. More than this the green manure *cum* fodder crop will hasten the reclamation of the project lands. Sunnhemp and Pillipesara grown in the area will serve as fodder for the cattle of the tract and more of farm-yard manure will become available for applying to the lands. As a result of all this heavy manuring, the samba yield also will increase. The Special District Agricultural Officer at Pattukkottai with whom this suggestion was discussed considered that it will be practicable. If it is not considered desirable to try this modified practice over the whole of the project area, it may be tried at least over a section of the project.

127. *Malabar—Problem in general.*—Apart from the deficiency of calcium and phosphorous in the soil, fodder also is in short supply in Malabar. During the monsoon and for one or two months after it, plenty of green grass will be seen and will be available for grazing. Thereafter till the next monsoon sets in, there will be dearth of green feed. Lack of facilities for irrigation and the difficulty of supply of water in non-rainy months accentuate the difficulty of growing any perennial fodder crop. Therefore the possibility of growing a leguminous fodder crop in rotation with paddy, the main crop of Malabar, will have to be investigated. The question of increasing fodder supply in Malabar was considered by us and it was thought that in the Paliyal and Modan lands it will be possible to do something. Silage also is another possibility. Apart from this the possibility of extensively growing fodder shrubs as against grasses may have to be taken up seriously. Mineral deficiency in the soil has also to be corrected in the feed. Rice straw is exported from Palghat taluk to Coimbatore, on account of the high prices prevalent there. In our opinion this export should be stopped and steps taken to utilize the straw within the district itself.

128. *Growing of leguminous fodder crops in Malabar.*—In the Agricultural Research Station, Pattambi, horsegram has been grown after paddy in single crop wet lands. This practice may be extended to ryots' fields also. The possibility of raising leguminous fodder crops has to be taken up seriously. For growing such crops the co-operation of the villagers will be necessary to prevent cattle from destroying the growing crop.

129. *Modan lands and green manure cum fodder crops.*—Modan lands are dry cultivated lands which are cropped once in three years. Paddy and gingelly are raised in these lands in one year and for the succeeding two years it is fallowed. These are really sub-marginal lands which will not bear repeated annual

cropping of food-crops. Without fallowing the land the possibility of growing a green manure *cum* fodder crop in non-paddy years may have to be taken up seriously, as this will not only give cattle fodder, but also reclaim such lands and ultimately make them fit for continuous cropping. A few demonstration farms may be necessary to demonstrate the possibilities to the public. There are 248,475 acres under current fallows in the district and their reclamation will be very desirable from all points of view. The public may look to Government for help in this connexion. It is suggested that any help given should not be in cash but should be limited to free seed, and probably remission of tax when the land is with a green manure crop.

130. *Growing of fodder shrubs and trees.*—In Malabar grass comes in abundance during the monsoon, matures quickly and dries up. During the short period when it will be fit for ensiling it will be rather difficult to get the necessary labour in most places. Reliance will have to be placed mostly on fodder shrubs and trees as they will be always available for utilization throughout the year. A systematic attempt should be made to grow mostly fodder shrubs in Government and private lands. Growing of Guinea grass and dry Napier grass may be popularized in Malabar. These grasses grow well in rainy months. During February, March and April they lie dormant only to shoot up vigorously with the mango showers.

131. *Silaging.*—Conservation of grasses and other green fodder by ensiling them when they occur in abundance should be taken up seriously in all places where labour difficulties are not acute. Silage has been manufactured in the Agricultural Research Station, Pattambi, using mostly grasses. During monsoon months when grass is available in plenty it can be collected at rates varying from 1½ annas to 4 annas per 100 lb. We saw some silage at the farm. It was of good quality and the cattle ate it avidly. Details regarding the production of silage at the Agricultural Research Station, Pattambi, are given below :—

Year.	Quantity of grass ensiled in	Quantity of silage obtained in	Cost of producing 1000 lb.		
	LB.	LB.	RS.	A.	P.
1939-40	72,010	46,462	2	0	0
1940-41	93,173	45,531	1	14	0
1941-42	92,463	58,328	1	13	0
1942-43	90,780	45,305	1	14	0
1943-44	100,100	65,310	4	10	0
1944-45	100,000	53,280	5	8	0
1945-46	50,000	36,015	5	2	0
1946-47	95,913	50,490	8	8	11
1947-48	32,156	24,360	4	14	7

132. *Mineral mixtures.*—The giving of mineral mixtures to cattle should be popularized as the Malabar soils are deficient in calcium and phosphorous.

133. *Resume.*—In the foregoing paragraphs a brief survey of the fodder position of the State and the possibilities of augmenting the fodder supply, by adopting scientific and intensive methods of cultivation and by growing a fodder crop either pure or in rotation with other crops have been discussed. The fodder position in certain important districts and the possibilities of getting in a fodder crop in the existing crop rotation have also been mentioned. The special problems relating to the Tungabadra Project area and the Cauvery-Mettur Project area of Tanjore were also stated and possible lines of approach to the problem mentioned. The proposals made in this connexion, especially those relating to private lands can at best be only tentative. Further enquiries and further examination are indicated. It must be stated here that according to most Collectors there have been generally no complaints from the public regarding the sufficiency or otherwise of fodder, in normal years. Only in years of severe drought when the crop completely fails, do they begin to agitate for supply of fodder from elsewhere. They do not realize that even in normal years there is a serious under production of fodder in our State and that our deficit is colossal. In a way the ryot cannot blame anybody except himself, for it is only he that has to grow the fodder necessary for his cattle, in his field. Apart from this the average ryot has become more money-minded. Direct money returns are what he cares for and not indirect benefits. Certain amount of ignorance also exists in matters relating to cattle feed and fodder production. Very early in our special duty we realized that fodder, milk production and land planning as such are not the concern of any particular department and that the co-ordination of the activities of those departments who deal with particular aspects of these problems, to ensure an integrated approach is still to be made effective. Also what struck us most was the absence of planning in *Agricultural* crop production. A policy of *Laissez faire* has been adopted hitherto in such matters. In the matter of selection of land for cropping and of the crops to grow on them the initiative rests with the individual and his interests may not always coincide with that of the nation. Therefore two things are essential, if we are to prosper as a nation (1) planned agricultural production, (2) co-ordination of the activities of all departments dealing with fodder.

CHAPTER VIII.

PLANNING, RESEARCH, CONSERVATION ETC.

134. *Agricultural planning.*—The need for agricultural planning was at no time felt more keenly than at present. With the announcement of the policy to stop all imports of food stuff, after two years and the necessity for becoming a self-sufficient nation before that period elapses, the need for planned production has become all the more important. Any planning of production of food must take into account the production of fodder also because

without cattle and cattle manure, agriculture cannot be practised efficiently. So what we want really is a composite plan aiming at the maximum production of food and fodder. Food will include fruits also. All conflict between money crops and food crops should be reconciled and whatever is necessary in the interests of national economy must be produced consistent with the rational use of the land. Such a planning should aim at producing on a sustained basis, the different crops, in the lands most suited to them at economic costs, so that maximum production may be achieved at the minimum costs. This will involve planning for production and supply of a suitable manures also. Such planning should be done on a self-sufficient regional basis to reduce transport of products to the minimum. At the same time, the plan should aim at the maximum return to the ryot. Such a plan should cover all lands which are under cultivation now. The lands which cannot be cropped continuously should either be reclaimed or reverted to trees or pastures. It is only under such planned agriculture our progress lies.

135. *Preparation of Agricultural Working Plans.*—Proper working plans for the agricultural management of the State have to be prepared, to achieve the different objects of management mentioned in the previous paragraph. A Senior Deputy Director of Agriculture associated with two or three gazetted officers with adequate subordinate staff will be able to produce practicable plans for the different tracts of the State within a reasonable time. When once such plans are produced and they are approved by Government, steps may have to be taken to enforce them. Legislative sanction will be necessary. These plans should also consider, the best and effective methods of achieving the objectives mentioned in the plan, without recourse to legal enactments. These plans should also indicate the various researches which may have to be undertaken to solve the local problems of the tracts covered by them.

136. *Research on grasses and other fodders—Agrostology.*—Simultaneously with the planning for crops, research work should also be initiated on the study of grasses and other forage crops and the pasture management. The Director of Agriculture has submitted a scheme which involves the appointment of an Agrostologist and two Assistant Agrostologists to be stationed at Coimbatore and at Bapatla. Agronomic and chemical assistants are also to be appointed. Whereas research work on fodder and forage crops has been receiving as much attention as food crops, if not more in other countries, in our own country, agrostology has not been encouraged adequately. The object will be the opening of a main Agrostologists section and the establishment ultimately of a chain of grass and fodder research stations in well-defined regions of the State both under rainfed and irrigated conditions. To each of these research stations a small herd of cattle both for breeding and dairying can be attached. They can incidentally be

utilized for feeding trials of the various grasses grown in the respective research stations. It was also proposed to study the nutritive value of grasses and fodder crops that give the maximum yield with high nutritive value in each of the regions. Nine research stations are envisaged. It is hoped that the work will be started soon so that results will be available when the porambores come under scientific management.

137. *Research on animal nutrition.*—The Government of Madras have forwarded a Scheme on Animal Nutrition to the Indian Council of Agricultural Research in January 1948. The technical programme of the scheme includes amongst other things the following items of work :—

(a) Investigation on the chemical composition of grasses grown in different soils and climatic conditions.

(b) Nutritive value of legumes suitable for introduction in the pastures to improve their feeding value.

(c) Special investigation on the hill type of pastures and soils on which they grow, with a view to develop dairy industry in the State.

(d) Investigation on the nutritive value, digestible co-efficient and mineral content of cultivated millet fodder crops and cereal State.

(e) Effect of manuring and cultivation on the composition of fodder grasses.

In our opinion most of the above studies can be conducted efficiently only if there is close co-ordination between the Forest, the Agriculture and the Animal Husbandry departments.

138. *Improvement of village cattle.*—Simultaneously with the steps taken for improving the fodder output of the province, steps must be taken to improve the quality of the village cattle. At present they are neither well-fed nor cared for. They are generally let out to wander in the village fields, when the fields are not under any crop and allowed to scrape whatever food they could get. No care is taken about their breeding. Any scrub bull irrespective of age is allowed to serve, producing miserable offsprings. Most of these animals, if properly handled, have a place in the economy of the village. Experience has shown that when the village cows are well fed and well looked after they not only yield more and better milk and produce stronger calves, but mature early and breed regularly. To improve the quality of the cattle in a village the following procedure may be adopted. To start with from the village herd, bulls and cows which are otherwise all right, but for malnutrition, are selected. These are herded separately and special areas out of the fuel and fodder reserves proposed to be created and the special grass farms, mentioned in paragraph 54 of this report, are allotted for their grazing. It is only these animals which will be comparatively better looked after that will be allowed to breed,

to produce better bull-calves and heifers. The number of cows to be selected and the bulls which will be required to cover them may be fixed in consultation with the officer of the Animal Husbandry department. To start with at least 60 per cent of the cows may have to be selected for breeding and if it is found that the oestrus cycle gets shorter, the number can be proportionately reduced. The other bulls in the village are castrated and the other cows are taken to different grazing grounds together with the castrated scrub bulls. Care should be taken to see that these non-selected scrub cows are not allowed to calve. It will be better if this selective breeding work is handed over to a village panchayat or to a co-operative society. The special grazing grounds, for those animals, which only are allowed to breed, may be leased out to these organizations, free if necessary, with sufficient safeguards to ensure success of the scheme. Slaying of the non-selected village cows will not be practicable nor is it recommended. With a certain amount of co-operation we may hope to see in the villages a better type of young stock, born to cows specially looked after and the gradual elimination by natural process of scrub cows and bullocks. It is not suggested that this method will grade up the cattle very much in short time as a breeding bull from a livestock station would, but will show what better fed and better looked after cattle can produce. The advantage of this system lies in the fact that the improvement of cattle need not wait for the arrival of a pedigree breeding bull.

139. *Possibility of further reduction in work cattle.*—With the extension of the electricity it is likely that electric pumping installations will be installed thereby releasing work bullocks which are now used for motive work. Also with the evolution of improved farming implements which will save cattle labour, reduction in the number of work bullocks will also be possible. If it is possible to use guntaka and gorru in the black and red soil areas of the south also as in the ceded districts, the strength of work-cattle may go down. Tractor ploughing will also reduce the number of work bullocks necessary, but it will not be possible nor desirable to use it extensively.

140. *Conservation of fodder.*—No less important than production of fodder is its conservation. While the cereal and pulse crop residues may be dried and stored, grasses cannot be stored similarly. The grasses develop luxuriantly during the rainy season and in that season it will be difficult to convert them into hay, because a chance shower might spoil the grass exposed for drying. In areas of high rainfall this is specially difficult. In these circumstances it will be advisable to preserve the excess green fodder available at any time as silage. Silage is the process of preserving green fodders for use as a succulent feed during seasons of scarcity. Preservation is done in pits or silos. The fodder is stacked and pressed to expel the air and then sealed out of contact with air. The sealing prevents or delays the decay of the fodder. In delta areas where the sub-soil water-level is high over-ground towers are to be

used for ensiling succulent fodder. In spite of the difficulties hay making with grasses is done on a small scale just at the closing stages of the monsoon. Hay and silage are fairly well known to deserve further description. There is another method of conservation which is called green crop or grass drying which is practised extensively in Switzerland and Sweden. The principle is to pass hot air for evaporating the moisture in grass, lucerne and other forage crops which are cut when they are young, so as to preserve their high caroten and protein content. Dried grass is such a rich food that it can replace concentrates. In England during the war, when concentrates could not be imported for want of shipping space, dried grass was used instead. The cost of dried grass was £7 a ton in 1937. This went down to £4 in 1939. In 1946 the cost again went up to £9 a ton. By using dried grass it is said that 200 herds of Ayrshire cattle can be maintained on 180 acres. Dried grass is probably not of economic importance to us at the moment. A fuller discussion on this subject will be found in a note incorporated as Appendix IV.

141. *Use of chaff cutters.*—If straws of cholam, cumbu, etc., which have a slightly woody stem are fed to cattle as whole plants there is wastage of fodder even up to 30 per cent inasmuch as the cattle eat mainly the leafy and tender portions and leave the rest. If however such fodder is chopped into small pieces and then fed to cattle the wastage is avoided. Suitable chaff cutters have been devised and they should be popularised.

142. *Rest stations for Trek cattle.*—It is a common practice in the coastal districts of Andhradesa to send the cattle away to the uplands and hills of Cuddapah and Kurnool districts for forest grazing when their lands are under cultivation. The trek is sometimes as much as 100 to 150 miles. During this migration the cattle get very little fodder and often times even water is not available to them in adequate quantities. Though the cattle benefit by the upland grazing, yet the starvation they undergo on their long return journey brings down their condition tremendously. So long as this seasonal migration exists, it is suggested that rest stations may be opened for cattle at regular intervals of 10 miles or so along the main trek route to Cuddapah and Kurnool districts. In such cattle-rest stations dry fodder must be available for cattle. In those months, when migration takes place. Water also should be available in plenty at those stations and also in between them. The actual sites for these rest stations can no doubt be selected by the local District Veterinary Officers.

CHAPTER IX.

SHEEP AND GOATS.

143. *Sheep and goats.*—From the December 1944 livestock census, there were 10,569,189 sheep and 4,565,656 goats in our

State. Sheep are found all over South India except in the heavy monsoon coasts of Malabar and South Kanara. They are kept in flocks of 50 to 100 by a class of people called "Murumbars, Edaiyars or Gollas." The flock owners lead a pastoral life moving from place to place with the herd in search of pastures. The sheep are reared for the wool and also for the meat. Besides, the flock are penned in the fields during nights and the field gets manured by the droppings of the animals. Sheep penning is an extensive and common method of manuring the fields in South India.

The goats are kept mainly for meat and their milk is a secondary source of income. They are reared by a nomadic class who own herds of a few hundred each and migrate from place to place in search of green forage for the animals. Many small ryots and labourers also own a few goats for a supplementary source of ready income by selling the animals to the local butchers. The flock are penned in the ryots' fields during nights, which fetches an additional income to the owner.

In western countries 'goat rearing' is popular to meet the milk supplies of small families where they are considered as 'poor man's cow.' They are mostly stall-fed and looked after well. In our State, stall feeding of goats is unknown. They browse leaves on trees and shrubs in all unreserves and porombokes. The goat owners have been responsible for the devastation of practically all the growth of the avenues and other places, by resorting to uncontrolled and indiscriminate lopping of branches. By its very nature, goat is destructive animal to all kinds of vegetation and if not properly controlled no tree growth will survive along the countryside. The destruction of the tree growth results in soil erosion and the consequent disastrous results that are attended with it. Legislation seems to be necessary to minimise the degradations.

On the west coast, however, there is a large scope for expanding goat rearing, especially of the milk-breed. In this region, owing to the deficiency of calcium and phosphorus, cattle do not thrive well and even good animals when taken there rapidly deteriorate. This area abounds in tree growth and consequently leafy fodder is available for goat rearing. Already a large number of goats are kept especially in North Malabar mainly for milk purpose. This should be further encouraged. Attempts should be made to introduce high milking breeds like the 'Jamnapari' breed of the United Provinces. In other places, it is desirable to reduce the number of goats or even totally prohibit them except when they are kept mainly for milk purpose. The Special Sheep and Goat Officer with whom we discussed, is of the opinion that the present scrub goat which is reared mainly for meat, should be eliminated and that all the meat requirements of the State can be met from the sheep. We also understand that by common consent goat

rearing is totally prohibited in some of the villages of Tanjore and Tiruchirappalli and Chingleput districts. The villages are—

Tanjore.	Tiruchirappalli.	Chingleput.
1 Arantangi	Most of the villages	Kalyanapundi
2 Selathur	of Kulithali	Thenyan Pundi.
3 Mookudi	Taluk.	

The economics of maintaining a dairy goat are given below. The figures were kindly supplied by Sri S. R. Sreenivasa Ayyangar, Senior Lecturer in Agriculture, Agricultural College, Coimbatore.

The economics of maintaining a dairy goat in a family.

Introduction.—Only a good milk-yielding goat should be maintained under extremely sanitary conditions. The nanny must be stall fed and taken out for light exercise. She must be looked after by the family members and no special attendant is necessary.

I A. Initial costs—

	RS.
(1) Purchase of a she-goat of a pedigree line.	100
(2) Stalls and other fixtures, for housing the animal for milking, etc.	50

B. Equipments—

(1) Utensils, feeding troughs, ropes, etc.	15
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C. Miscellaneous items	10
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Total ... 175

II. *Maintenance charges.*—The nanny will have two lactation periods in a year, each period for four months. She will require extra ration during the milking period. Details are shown below :—

	COST.		
	RS.	A.	P.
1 Basic ration all through the year (365 days).—			
(a) Tree leaves, other leaves, (varieties) Agathi leaves, Jack leaves, cut grasses, etc. 15 lb, fed thrice.	0	3	0
(b) Rice bran $\frac{1}{2}$ lb. fed once	0	0	2
(c) Common salt $\frac{1}{8}$ oz.	0	0	1
Total ..	0	3	3

Cost of feeding for one year $65 \times \text{As. } 0-3-3 = \text{Rs. } 74-2-3$ (i)

RS. A. P.

2 Extra ration for milk period of 8 months (240 days).—

(a) Groundnut cake 1 lb.	0	1	3
(b) Gram meal $\frac{1}{2}$ lb	0	1	6
(c) Mineral mixture $\frac{1}{2}$ oz.	9	2	10
Cost of this special ration for 240 days at 9 2-10.	43	4	0 (ii)

3 Other items.—

(a) Salt lick 1 lb. block	0	10	0
(b) Service charges	2	0	0
(c) Medicinal charges, etc.	4	15	9
Total ..	7	9	9 (iii)

Total of (i), (ii) and (iii) Rs. ... 125 0 0

III. Overhead charges—

(i) Interest on investment at 6 per cent ..	10	8	0
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(ii) Depreciation—

(a) For the animal at 20 per cent ..	20	0	0
(b) For utensils, ropes, etc. at 33 $\frac{1}{3}$ per cent.	5	0	0

Total .. 25 8 0

Value on market

RS. A. P.

IV. Income—

(i) Milk yield for 240 days at 8 lb., on an average per day 1440 lb. valued at As. 4-6 per lb.	405	0	0
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(ii) Sale of kid (one six months old) (if it is a pedigree goat, the kid will fetch Rs. 50).	15	0	0
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(iii) Manure collected with sweepings, etc. two cart-loads per year at Rs. 5 per cartload.	10	0	0
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Total .. 430 0 0

				Value at market rate.		
				RS.	A.	P.
Profit and Loss account—						
1. Expenditure—						
(a) Maintenance charge—	}	..	..	125	0	0
vide II						
(b) Overhead charges—	}	..	..	35	8	0
vide III						
Total	..	..	..	160	8	0
Profit—						
Income vide item IV	..	..	..	430	0	0
Expenditure ..	..	..	..	160	8	0
Net	..	..	..	269	8	0

It is presumed that the goat is attended by the family members. The production costs of goat's milk per lb. is given below:—

A. Expenditure—						
(i) Maintenance charges ..	..	..	..	125	0	0
(ii) Overhead charges ..	..	..	..	35	8	0
Total	..	..	..	160	8	0
B. Income from secondary sources—						
(i) By sale of kid ..	..	..	..	15	0	0
(ii) Value of manure ..	..	..	..	10	0	0
Total	..	..	..	25	0	0

C. Net expenditure debitable to milk production Rs.
160-8-0 minus Rs. 25-0-0 = Rs. 134 8-0.

D. Total milk yield during eight months in 1440 lb.
The cost per lb. of goat's milk—As. 1-6.

CHAPTER X.

LAND UTILIZATION.

144. *Land utilization.*—It is not proposed to cite here instances of misuse of land which are occurring to-day in our State, because there is no such thing as land planning and no particular department is responsible for it. Beyond an executive order that Government lands having a slope of more than one in four, should not be assigned for cultivation in hilly tracts there does not appear to be any other soil conservation measure. The recent Grow

More Food Campaign has resulted in considerable loss of top soil because reckless cultivation was practised without undertaking soil and water conservation measures on account of the nature of the tenure. The State Silviculturist has noticed serious soil erosion, the washing away of 2 to 6 inches of soil in two years, in the Grow More Food potato fields of Nilgiris. In some tea plantations one foot of soil has also been washed away, according to him.

Over decades, improper land utilization has been going on due to lack of proper land planning. As an instance may be cited the Godavari delta region. The wet cultivation there has extended to the extent that the cattle of that region have not even standing space when the crop is on the field and they are sent away to the uplands for grazing. Instances of serious soil erosion have been given in the official book on "Soil Erosion—its Prevention and Control." The menace of soil erosion has been recognized and steps are under contemplation for the conservation of soil and moisture by proper land utilization. An expert committee of the Government of India recently visited this State and their recommendations will no doubt be examined and implemented. If the proposals mentioned earlier in this report are accepted about 39 million acres of land out of the 79.9 million acres, the area of the State will be under management of some Government department or other. We shall close this subject after laying stress on the main objectives of any serious attempts at land planning. These are—

(1) to obtain for the owners of the land and for the community and the Government the maximum possible return in proportion to the capital and energy applied;

(2) to protect the ryots from the results of unwise expansion and to give such assistance as may be possible to the efforts being made to make our country self-sufficient in food and fodder;

(3) to assist in the adjustment of the economic programme of the ryots to suit the changing conditions;

(4) to conserve for the general public of this and future generations the natural resources, including soil and its fertility; in the maintenance of these resources in unimpaired productivity, private interests must give way to public interests; and

(5) to provide information concerning adoptions and probable future utilization of lands which will ensure progressively greater efficiency both in land use and in the administration and financing of the several activities of Government and public bodies.

CHAPTER XI.

MILK PRODUCTION, DISTRIBUTION, ETC.

145. *Factual information regarding production of milk.*—In our State, dairy farming is not an organized industry. Much of the milk is produced and sold by milkmen, who own two or three

animals. There are other small owners also for whom milk business is only a side trade. Mostly cows and buffaloes are maintained. Milch goats are kept mostly in the West Coast but their contribution to the total milk supply of the State is negligible. In 1914-15, the following number of milk animals existed in the State:—

Cows over 3 years	...	4,019,920	} 6,615,698
She-buffaloes over 3 years	...	2,595,778	
Goats over 1 year	...	3,639,043	

Accurate statistics relating to urban cattle are not available. For Madras City, the Veterinary Officers of the Corporation have estimated the number of milch animals kept at 16,500. Taking the whole State there are only 13 milk animals for every 100 persons. Maintenance of herd books or registers of milk yield are unknown in the State except in some of the Government farms. In the circumstances, figures relating to total milk production will be largely guess work. In the seven tracts enquiry conducted under the auspices of the Indian Council of Agricultural Research, 20 holdings were selected at random in each of about 50 villages, also chosen at random, in the Ongole tract. Milk yields of about 880 she-buffaloes and 610 cows were recorded for a period of seven consecutive days. Lactation details were also collected. Results of this investigation in Ongole tract gave the following information:—

	Cow.	She-buffalo.
Milk yield per day	.. 4.64 lb.	6.53 lb.
Length of lactation	.. 9.54 months.	11.30 months.
Lactational yield	.. 1,236 lb.	1,903 lb.

Ongole tract is not typical of the State nor for the matter of that, the Ongole cattle. When compared with the non-descripts which form the bulk of our milkers, they are certainly much better. Taking the dry period also into consideration the average overall annual production worked out to 680 lb. for a cow and 1,050 lb. for a buffalo. With this as the basis the State Marketing Officer has worked out the probable milk production of the State, for the year 1940, as 247.27 lakhs of maunds of cow milk and 261.88 lakhs of maunds of buffalo milk. On the same basis, adopting the latest livestock census figures the total annual production of milk of the State works out to—

	LAKHS OF MAUNDS.
Cows	198
Buffaloes	231.3
Total	429.3

The yield of milk from goats was worked out at 5 lakhs of maunds for 1940. Buffaloes though they form only 65 per cent of the cow population yet they produce 20 per cent more milk than the cows.

146. *Comparison of milk yields of Madras cattle with those of other States and other countries of the world.*—The annual yields of milk of the Madras cows and buffaloes are very poor when compared with the rest of India as the following statements will show. The cows' rank is 21 out of 36 and the buffaloes', 27 out of 36.

(1) *Milk yield of Indian cows.*

States.	Approximate annual yield per cow in lb.	States.	Approximate annual yield per cow in lb.
Punjab	1,445	Cochin States	480
Sind	1,315	Bengal and neighbour States	420
Baluchistan States	1,290	Madras State	410
Delhi	1,270	Travancore	410
North-West Frontier Province	1,200	Other Madras States	400
Khairpur state	1,200	Orissa	350
British Baluchistan	1,000	Barda	345
Western Indian States	1,000	Decan States	300
Patiala	990	Kashmir	280
Other Punjab States	900	Mysore	240
North-West Frontier Province (Agency and tribal areas)	780	Coorg	200
Central India States	780	Bombay	140
Rajputana	780	Assam	140
United Provinces and Ajmer	680	Assam States	140
Bihar	620	Hyderabad	130
Gujarat Agency	600	Central Provinces, East- ern States and Bundel- khand Agency	65

(2) *Milk yield of Indian buffaloes.*

States.	Approximate annual yield per buffalo lb.	States.	Approximate annual yield per buffalo lb.
Western Indian States	2,500	North-West Frontier Province (Agency and tribal areas)	900
Punjab	2,320	British Baluchistan	900
Sind	2,320	Rajputana	900
Patiala State	2,135	Bombay State	880
Delhi Province	2,000	Nizam's Dominions	825
Barda State	1,810	Decan States	800
Baluchistan States	1,800	Cochin State	800
Bihar	1,650	Madras States (excluding Travancore and Cochin)	800
North-West Frontier Province	1,630	Madras State	550
Khairpur State	1,500	Orissa	780
United Provinces	1,340	Mysore State	780
United Provinces States	1,340	Kashmir State	550
Punjab States (excluding Patiala and Khairpur)	1,300	Central Provinces	520
Central India States	1,000	Eastern States	545
Gujarat States	1,000	Coorg	800
Bihar	900	Bundelkhand Agency	445
Madras State	800	Assam	315
Travancore State	810	Assam States	315

(3) *Milk yield of cows in important countries of world.*—*

Countries.	Approximate milk yield per cow.	Countries.	Approximate milk yield per cow.
	LB.		LB.
Netherlands	7,559	France	3,775
Denmark	7,005	Norway	3,723
Belgium	6,859	Italy	3,496
Switzerland	6,498	Australia	3,463
Japan	5,857	Sweden	3,431
England and Wales ..	5,576	Canada	3,195
Luxemburg	5,620	Poland	3,020
Scotland	5,386	Egypt	2,663
Germany	5,305	U.S.S.R.	2,334
New Zealand	5,118	Turkey	2,225
Austria	4,629	Chile	1,488
Eire	4,576	Lithuania	1,223
Northern Ireland ..	4,492	Argentina	971
Finland	4,200	Greece	970
United States of America ..	4,126	India (cow and buffalo)	753
Hungary	4,076	Algeria	643
Czechoslovakia	4,060	Madras (cow and buffalo)	532
Estonia	4,020	Burma (cow and buffalo)	418
Latavia	3,936	Uruguay	271

* International Year Book of Agriculture 1935 and Statistical Year Book of the League of Nations 1937-38—Figures generally relate the year 1935 (India, Burma and Madras not included).

From the above statements it will be clear that our milk animals are very poor milkers. By general neglect, under-feeding and indiscriminate breeding most of our cows have become non-descript wastrels yielding very poor milk and poorer progeny. The need for improving them is therefore urgent. We are reassured that we are likely to succeed in this endeavour since the countries which have made rapid strides in the improvement of their milk stock in the course of half a century had to start with a foundation stock very similar to ours. By proper and better feeding, careful breeding and management, the milk production can be increased. By better feeding alone, village-kept Ongoles give 50 per cent more yield in the City of Madras. Others hold that a cent per cent increase in yield will be possible by feeding alone. The following extract from the Marketing Report of 1941-42 is a pointer in this direction:—

“ . . . Village cows when brought to the Government farms give on an average 60 per cent more milk in their subsequent lactations. The first progeny of these cows show a further improvement of 10 to 15 per cent in their milk yields over and above the increase recorded by their dams ”.

Therefore in the initial stages the crux of the problem lies in feeding the cattle better.

147. *Milk available for supply in the Madras State and per capita consumption.*—According to the Provincial Marketing Officer about 5 per cent of the milk production is retained by the producer himself. Therefore the quantities of cow and buffalo milk available for marketing per annum will come to 188.1 and

219.7 lakhs of maunds respectively. Placing the population of our State at 50 millions the *per capita* consumption of milk comes to only about 8.1 oz. per day. This includes the 5 per cent deducted above.

148. *Per capita daily consumption of milk in India compared with other States and also countries.*—The *per capita* daily consumption of milk in 1941-42 in Madras State and in other countries is given in the following statements:—

State.	Daily per capita consumption of milk.	State.	Daily per capita consumption of milk.
	OZ.		OZ.
Sind	22.0	Kashmir State ..	4.5
Punjab	19.7	Nizam Dominions ..	3.6
Rajputana	15.6	Mysore State ..	3.6
Central India	11.6	Madras State ..	3.6
North-West Frontier Province ..	10.2	Bombay State ..	3.3
Delhi	7.8	Bengal	2.9
United Province ..	7.8	Orissa	2.5
Behar	6.1	Central Provinces ..	1.8
		Assam	1.2

*Per capita consumption of milk and milk products in certain countries.**

Country.	Daily per capita consumption.	Country.	Daily per capita consumption.
	OZ.		OZ.
Canada	56.8	United States of America	35.6
New Zealand	55.6	Germany	35.0
Switzerland	49.2	Belgium	33.0
Finland	45.4	France	30.4
Australia	44.4	Czechoslovakia	28.3
Netherlands	44.2	Austria	18.8
Norway	41.7	Italy	10.1
Great Britain	40.7	India	6.6
Denmark	40.3		

* The problem of nutrition—League of Nations 1936 and Milk Plant (monthly) February 1937 (India not included).

According to nutrition experiments carried out at Coonoor to supply the daily requirements of first-class portein for an adult, 15 to 30 oz. of milk will be necessary. This varies with the age and work and other conditions of the person concerned.

149. *Consumption of milk in urban centres.*—Though the overall average for the State is only 8.1 oz. of milk *per capita* per day yet the *per capita* consumption is more in urban centres. An estimate was made at a few centres by the State Marketing Officer in 1941. The figures are given below:—

Urban centres	Daily per capita consumption of milk and milk products.	Urban centres.	Daily per capita consumption of milk and milk products.
	OZ.		OZ.
Madurai	8.2	Coimbatore	6.8
Tiruchirappalli ..	7.1	Salem	6.6
Madras	6.9	Kozhikode	5.2

The reason for increased consumption may be traced to the higher purchasing power of towns-men and the existence of numerous tea and coffee hotels in such centres.

150. *Prices of milk.*—On account of the perishable nature of milk it has to find a quick and local sale. As long distance transport of milk is still in an experimental stage and refrigerator arrangements are not available in trains, extremely local factors determine the price of milk. Even such factors as earliness or lateness of delivery affect the price of milk. It has been recorded that the Indian producer gets almost the same price as that received by producers in the United States of America and Europe. The Indian consumer notwithstanding his low purchasing power has still to pay as much as an Englishman does for his milk in England. This particularly explains the small consumption of milk by Indians.

151. *Cost of production of milk.*—To the rural owner the milk is only a by-product. He does not give the cows any special feed and they are kept because they produce bull calves and also give him manure. "Milk" is only incidental to the keeping of the cow. The cost of production of milk in his case is practically 'nil'. In the Hosur Cattle Farm in 1947-48 there were 57.8 Sindhi and 50.5 Kangayams. The overall daily averages of milk yields were 8.7 lb. and 2.1 lb. for the Sindhis and Kangayam respectively. The animals were milked three times a day as this increased the milk yield by 15 to 20 per cent over the yield obtained by milking only twice a day. This practice however is confined mostly to heavy milk yielders. Five lakhs twenty-seven thousand and six hundred and seventy-two pound of milk were produced at a cost of Rs. 71,012. This works out to As. 2-2-2 per lb. or say As. 8-8-8 per Madras measure. With a larger herd we were assured that the cost of production will go down still further. Attached to the Agricultural College at Coimbatore there is a dairy farm kept mainly for instructional purposes. Here 36,081 lb. were produced in a year and the cost of production of 1 lb. of milk worked out to As. 6-8. In the same College Dairy when larger herds were probably kept, the cost of production was as follows:—

Year.	Cost of production.		
	RS.	A.	P.
1938-39	0	1	6
1939-40	0	1	4
1940-41	0	1	3

At Bangalore in the Military Dairy Farm the cost of production of the reconstituted milk came to about 5 annas a lb. This was due to their not being able to get green fodder, and to getting their hay from Bellary which works out to about Rs. 100 per ton.

The officer-in-charge told us that under present conditions the cost of production will not go higher than about 4 annas a pound. In Kozhikode in a private dairy farm the cost of production went up to nearly 8 annas a pound. At all the place mentioned the milk produced is sold at economic rates on account of the prevalent high prices.

152. *Transport and distribution of milk.*—For want of regular, cheap and fast transport arrangements, it is not possible to collect milk from a larger area round urban centres. There is very little movement of milk in our State. If railways can supply wagons fitted with refrigerating arrangements milk for urban centres can be brought from longer distances. Economic dairy farms can also be started then in rural centres where facilities for growing fodder will exist and cheap milk can be made available in urban centres. When the distance to be traversed is between 2 to 5 miles, cycles are generally used. Some big milk unions are using motor vans also for transporting milk.

153. *Co-operative methods of procurement and supply of milk.*—Milk co-operative societies are becoming more and more popular. The salient features of their working may be summarized as follows:—

- (1) Purchasing of members' milk for sale to consumers;
- (2) taking of precautions to prevent adulterations of milk;
- (3) payment of loans on easy terms to their members for the purchase and feeding of milch animals. The loan amount is recovered in instalments from the value of milk supplied by members;
- (4) contribution of 25 per cent of the profits to a reserve fund and distribution of the rest as bonus or dividend or as a contribution to the common good fund.

The co-operative milk supply societies and unions had their usual vicissitudes but now they have come to stay. The biggest of them, the Madras Co-operative Milk Supply Union, Limited, Madras, was started in 1926 after many unsuccessful attempts. The animals are milked by the members of the society at a central place in each village under the supervision of a paid agent of the union. He keeps the accounts as well and arranges for the milk to be taken to the roads side where it awaits the motor van of the union. The union has motor vans which leave Madras for collecting milk at 5 a.m. in the morning and returns at 10 a.m. Each van can handle 30 cans of about 60 lb. capacity each. Collection and transport of milk from the villages to the dairy comes to about 10 annas per maund. Cost of pasteurization was originally about 8½ annas per maund, but during the war period it went up to 13½ annas owing to the rise in the price of coal and oil. The union handled only about 38,425 maunds of milk in 1940-41 but

in 1947-48 it handled more than double that quantity, about 83,625 maunds. One Co-operative Sub-Registrar, seven Senior Inspectors and seven Junior Inspectors at Government cost are associated now with this union. As on 30th June 1948, the union had 70 individuals and 88 milk-supply societies as its members with a total paid up share capital of Rs. 96,152. During 1947-48 it purchased 69.13 lakhs of pounds of milk, i.e., about 83,625 maunds valued at Rs. 17.50 lakhs. It sold 63.79 lakhs of pounds of fluid milk for Rs. 19.49 lakhs during the year. The distribution of the milk was made through 60 depots maintained by the union in the several parts of the city and door-to-door delivery was also arranged through house delivery boys. The union arranged to purchase and supply cattle feeds to its members to the value of Rs. 1.75 lakhs during 1947-48. The union also runs a dairy at the Government House, Guindy. At present the union handles 6,000 lb. of milk a day.

Taking the whole State, on 31st December 1948, there were 25 milk-supply unions with 235 affiliated societies; besides 104 milk supply societies did business independently. The unions had a membership of 3,296 and a share capital of Rs. 2.23 lakhs. The societies had a membership of 15,309 with a paid up share capital of 1.95 lakhs. The following statement shows the business done by milk-supply societies and unions during the quarter ending 31st December 1948.

Particulars.	Milk-supply Societies.		Milk-supply Unions.	
	Quantities.	Value.	Quantities.	Value.
		RS.		RS.
	LB.	IN LAKHS.	LB.	IN LAKHS.
Purchases ..	33.77	7.27	51.87	13.36
Sales	29.87	7.45	49.62	14.15

154. *Resume.*—An idea of the milk production of the State the milking capacity of the cow and the she-buffalo, the *per capita* daily consumption of milk, the collection and distribution of milk have been given. The production of milk by local animals has also been compared with yields of animals from the rest of India and some other countries of the world. The *per capita* daily consumption of the milk of the State has also been compared with similar consumption in the rest of India and other countries of the world. The cost of production of milk in a few centres has also been given. The methods of collection and distribution of milk adopted have also been described. The part played by milk co-operative societies and unions has also been mentioned. Now it is proposed to consider the methods by which the overall production of milk can be increased and how urban milk-supply including Madras can be improved. The rural milk-supply problems have to be considered separately from those of the urban as the problems are different.

155. *Possibilities of increasing rural milk production.*—Milk production in animals can be increased mainly by (1) feeding and (2) by breeding—

(a) *Feeding.*—Feeding means that adequate balanced rations should be given. In the earlier portions of this report various steps have been suggested which if adopted will give both green fodder and dry roughage to the rural cattle. Green grass grazing by itself will increase the milk yield by 10 per cent to 20 per cent. As a result of getting more adequate rations, the village cows will yield more milk and a considerable increase may be expected, in coming years, depending on the progress, made in carrying out the various suggestions for increasing the fodder output.

(b) *Breeding.*—The only practical method of improving the quality of the village cattle has already been suggested. The essence of the system lies in allowing only selected bulls of the village to breed on selected cows. The animals are to be herded separately and better fed and looked after. The other non-selected bulls will all be castrated. It is only after knowing the full capacity of our so-called scrub animals to improve under proper maintenance, should we think in terms of grading up the cattle. Opinions of Sir Norman C. Wright, Doctor Hammond, Mr. F. A. Stockdale on this important question of breeding is given below: "Extensive breeding experiments which have been carried out at various centres show that by careful selection, indigenous strains of Indian cattle can be built up which are capable of giving remarkably high yields. There are many examples of potentialities of indigenous breeds to give high milk yields. The policy of encouraging the breeding of such indigenous stock in preference to cross-breeding has been strongly advocated in other tropical countries. Apart from the time it would take there is no evidence that mere selection (combined with better feeding) of the local stock would not produce equally good results. A policy of rigid selection from the local cattle would be more calculated to produce results of lasting value than could be achieved by the introduction of the blood of strains of cattle from outside".

156. *Urban milk-supply.*—For supplying milk to urban centres a very large number of good milkers are imported paying high prices. They are kept for one lactation and then they are disposed of because it will be very uneconomic to maintain a dry animal in urban centres. These good milk yielders which are brought, have to live under very unhygienic conditions. They live on an ill-balanced diet, with concentrates predominating and rarely get any green feed. What is more, they seldom get any exercise and no wonder they deteriorate rapidly. Oftentimes their calves die due to starvation or done away with. To supplement the urban production, milk from the neighbouring villages

are brought into the City. Co-operative organizations have sprung up and the role they play in collecting the milk from rural centres, transporting them to urban centres and distributing them to consumers, has already been described. In spite of all these attempts urban milk-supply is insufficient, as the statement of *per capita* daily consumption of milk given earlier will show. Oftentimes the milk is adulterated and the public rarely get good milk if they buy from itinerant hawkers or milk not milked in their presence. On account of this fear of adulteration the tendency on the part of the middle class and well-to-do people is to keep their own cows or make the milkmen milk the cows in their presence. But salvaging them when they become dry is a problem for the city cow owner.

In the City of Madras the local milkman usually keeps cross bred animals which are heavy milk yielders. He is usually a small owner. Apart from this class of milkmen, others also carry on a small side trade in milk. This class of people is fast increasing in numbers. The price of milk varies from Re. 1 to Re. 1-4-0 a Madras measure or about 4 annas to 5 annas a pound. A proposal was made a few years back to evacuate the milkmen from the crowded Georgetown and Triplicane and to colonize them and their animals in the suburban villages. The cost of the scheme even at pre-war rates came up to 30 lakhs and this is for a partial evacuation. Such a colonization scheme is very unlikely to succeed when we deal with a heterogeneous crowd of people who deal in milk. One would have thought that there was no need to take these very people who are engaged in the trade. With this money a first-class dairy farm can be started just outside the city in a suitable locality. The milkmen of the city would take to some other calling. In any event as the scheme is not likely to be proceeded with its details need not be fully discussed now.

157. *Madras City milk plan.*—A milk plan for the City of Madras was prepared by Mr. Murai in November 1948, after discussing the problem with the Commissioner of the Corporation of Madras, the Dairy Development Officer, Madras, and the Dairy Development Adviser to the Government of India.

Mr. Murari places the number of milk cattle within the Madras City at 8,000 whereas according to the veterinary officers of the Corporation it is 16,500 as per a recent survey. Further according to the Co-operative Department, the Co-operative Milk Union handles only 8,000 lb. of milk a day. Adopting these modified figures the daily supply of milk to the City of Madras comes to 181,000 lb. The scheme envisages the appointment of a Milk Commissioner working under the Corporation. His function will be to organize the milk production, to control the quality of milk and to supply milk to the whole city. He will purchase

on quality basis all the milk produced for the purpose and undertake to distribute the same.

All milk intended for the city to be produced outside it and the *per capita* consumption should be increased to 16 oz. per day. The first step will be to increase the production of milk and not to strip the rural supplies of milk for meeting the urban demand. This will be achieved by importation of better cattle, by judicious breeding and by scientific management to ensure maximum and continued supply. A large scale dairy farm was to be started at Vandalur with dry and young stock farms inside Gudalur Reserved Forest area. The dairy farm will have at least 500 animals in milk. The distribution will be as follows: 100 Sahiwal or Scindhis or Tharparkars, 50 cross-bred and 350 buffaloes. If the up-country breeds are not available they are to be made up by good cross breeds taken over from the milkmen of Madras. In the dairy farm there will be stalls to house about 100 privately-owned milch cows. The milk produced by these cows will be handed over to the dairy. About 6,000 lb. of milk per day will be supplied by this dairy. At the same time it will take any quantity of milk for processing. When this programme is in progress, adequate number of wards in the city will be closed for local milkmen. Private owners will be permitted to keep cows for producing milk for their own use. The Milk Commissioner will also assist the organization of private dairy farms outside the city and undertake to purchase all their production on quality basis. The Commissioner will also open other farms in which city milkmen may house their cattle. When this has been achieved the Commissioner will buy all the milk produced by the co-operative societies whether in or outside the city and give adequate time for the co-operative societies within the city to move out of the City. The Milk Commissioner will arrange to supply fodder and concentrates, etc., to all the dairy farms and milk unions that are under his control. If the above proposals were adopted, the Milk Commissioner will be in a position to organize the milk-supply of the city within a period of five to ten years.

Under this scheme 64,000 lb. of milk will be handled in a day. The total expenditure on the scheme will come to Rs. 78,05,740 out of which Rs. 65,35,740 will be recurring. Total receipt was estimated at Rs. 72,37,000. In the first year the deficit will be Rs. 5,68,740. We do not know in what stage the scheme is, but the idea behind the scheme is essentially sound but the only modification we would suggest is that the scheme should be run by the Government themselves. It is not also known whether the dairy animals will get any green fodder, and if so, the provision made for the same will have to be scrutinized. Cheap green fodder should be made available to the dairy cattle to improve their milk production.

158. *Growing of green fodder.*—In our opinion the first step to be undertaken for increasing urban milk-supply will be to supply green fodder at cheap rates to the milch animals. This alone will give an increase in the yield of milk by 10 to 15 per cent. The cheapest way of raising green fodder will be by utilizing either the sewage or sullage water. If these are not available composted manure may be utilized instead. As sewage water contains valuable manure, the growth of the plant will be very luxuriant and yield will be very high. Whether this sewage water should be used only for raising fodder crops or for any other crop has been the subject-matter of controversy. The Bio-Chemist of the Indian Institute of Science, Bangalore, has conducted studies in sewage purification and farming and his findings are given in the next paragraph.

159. *Studies in sewage purification and sewage farming by the Bio-Chemist of the Indian Institute of Science of Bangalore.*—It is proposed to give here only very brief details regarding the work done on sewage at Bangalore just enough to help one to understand the principle involved in sewage irrigation and how best it can be utilized. Sewage is very rich in combined nitrogen, and as such it will be an excellent manure for producing leafy growth. Sewage irrigation need be confined only to the early stages of crop growth. The trend of evidence would show that response of crops depends upon their nutrition in the early stages of growth and that heavy application of sewage after the commencement of flowering is not beneficial to plants and has even an adverse effect on them. *Fodder and sugarcane appear to be the most suitable crops.* The yields of fodder grass, such as Rhodes grass, Guinea grass and fodder cholam vary from 60 to 120 tons per acre per annum and the yields of sugarcane (H.M. 320, C.O. 419, C.O. 413, P.O.J. 2878) vary from 40 to 80 tons per acre. *Soils containing less than 25 per cent clay are generally suited for land treatment of sewage and crop production.*

The nature and extent of infection carried by sewage grown crops were also studied. The findings were as follows: The putrefactive and pathogenic organisms do not penetrate into sewage grown crops though they are invariably present on the surface. They are present in high concentration on crops such as cabbage and lettuce which grow very near to the soil surface. They are introduced partly through mechanical splashing of sewage and partly through blowing dust on dry days. They are largely removed through washing but they are never completely eliminated even after cooking. In the case of vegetable like lettuce which are eaten raw there is always a certain amount of danger of these organisms being taken along with the vegetables. In addition to this there is a suggestion that sewage grown crops contain certain water soluble principle formed through bacterial action and absorbed through the roots. This aspect deserves

further study as it may have a direct bearing on the nutritive value of sewage grown market garden crops. The irresistible conclusion which may be drawn from the above studies is that sewage is best suited for growing a fodder crop. A fodder crop grown under such an irrigation will give very heavy yields. As a result, the cost of production will go down and the cattle will get green fodder at cheap rates. As such sewage farms can be located only very near big urban centres, the green fodder will be available to urban cattle who will require it most. These sewage farms are extremely profitable propositions as Madura experience has shown.

160. *Suggestions for improving urban milk supply.*—According to the Bio-Chemist fodder and sugarcane appear to be most suitable crops to be grown with sewage water. Sugarcane however can if necessary be grown elsewhere. But it is essential to grow a fodder crop very near urban centres for the benefit of the milch animals. In the circumstances the best use to which sewage water can be used is to grow a fodder crop with it and supply the green fodder to the urban cattle. This is the starting point of the proposals for increasing the supply of milk in urban centres. The following will be the different stages:—

(1) Growing of a green fodder crop like Guinea grass, Rhodes grass, etc., very near the town in localities which are considered suitable for sewage farming either with sewage water or sullage water or with compost manure. If compost manure is used, wells may have to be sunk to irrigate these fodder farms.

(2) Supply of this green grass at cheap rates to urban cattle. This will increase production by 10 to 15 per cent.

(3) Opening of dairy farms by Government or local bodies near the sewage fodder farms. In the initial stages cross-bred animals may be necessary to step up production till the indigenous milch breeds are developed.

(4) With the gradual increase in the production of milk in the dairy, private sales of milk will also be gradually prohibited inside the town till ultimately when the dairy is able to supply the whole of the requirement of the towns, private sale of milk in the town will be completely prohibited.

(5) As an adjunct to each sewage-cum-dairy farm, at reasonable distance from it by road or by rail, a natural pasture land of sufficient extent will be selected. These will be used for ranching dry cows and for rearing the calves of the dairy. When the cows calve again they will be sent back to the dairy farm.

In our opinion the above gives the outline of a possible way of solving this urban milk-supply problem. The idea is to create small milk cities outside the town, where the cattle will be housed properly, fed properly and exercised properly.

The milk from these dairies will be distributed, only after it is pasteurised. Thus good, pasteurised and clean milk will be available to the public in urban centres.

161. *Madurai sewage farm.*—Before the schemes suggested for Madras and other places are described it will be good to know what has been done in Madurai. The Madurai sewage farm was opened in 1926. It is 113 acres in extent. It is about 4 miles from Madurai. The soil is fairly porous. At the higher levels it is rather gravelly while at the lower side it is a red loam. The original land cost about Rs. 25,000 and the channels and the underground drains cost about Rs. 1,12,000. The cost of the cast iron main 24 inches in diameter used for bringing in the sewage water has not been included in this cost.

162. *Engineering details.*—The raw sewage is pumped from the main pumping station in Sandapettai East street from level +117.74 feet to +137.83 feet over a distance of 26,478 feet. The discharge is 5,456 gallons per minute. There are three engines each of 60 h.p. out of which two work at a time. The cost of pumping comes to about 29 pies per thousand gallons. Twenty-four inches cast iron mains have been laid out. Out of a total population of 310,000, of Madurai only about 200,000, are connected to the sewers. Out of the sewage water collected, 40 per cent goes out as overflow. The actual sewage water received at the farm varies from 15 to 21 lakhs of gallons per day. There is no preliminary treatment of the sewage. Only silt and floating matter are screened off at the six sewage pumping stations to facilitate pumping. At the sewage farm the 24 inches cast iron pipe opens out into a small cistern. From this cistern the sewage is taken through main open channels to the fields for flood irrigation. Three to four feet below the field level, disjointed, continuous earthen ware pipes of 3 inches internal diameter have been laid out, in lines at 33 feet intervals, at a gradient of 1 in 100 feet which is also the natural slope of the land. The effluent from these sub-soil pipes are collected in an upper and lower, open effluent channel built in random rubble grouted with cement. The gradient for this effluent channel is 1/2500.

163. *Details of cultivation.*—The filter bed area is 113 acres in extent out of which 96 acres are under Guinea grass. The balance is under vegetables, cereals, sugarcane and orchard. Guinea grass slips are planted at 18 inches intervals in lines. Nineteen thousand three hundred and sixty slips are required for planting an acre. These slips are sold at 8 annas per 100 slips. The planting area is ploughed at least twice to a depth of 3 inches at least. The slips are planted at prepared spots in April-May. Immediately after planting the plot is flooded with raw sewage to a height of three inches. After three days it is again irrigated. Subsequent irrigations are done at intervals of a week. The dead shots are removed once in six months. The grass will be ready

for the first cutting 60 days after planting. The plots are cut at intervals of about forty days. About nine cuttings are taken in a year. At the time of cutting the grass will be about 4 feet to 5 feet. The slips planted originally in 1927 have not been replaced. There has been no necessity to do this as sewage sickness has not occurred so far. All that is done is to remove the dead material. When grass is planted in a new area natural seedlings are preferred. During the rainy season the yields are actually low because the manurial ingredients are leached out into the effluents by the rain water. Sewage sickness has been avoided by taking the following precautions: (1) judicious application of sewage; and (2) removal of sludge deposits every six months from the sewage farm. These sludge deposits are between 30 to 50 tons to the acre. These are sold to the public by the contractors, at about Rs. 8 per cart-load or three-fourths of a ton. It is a first-class manure.

164. *Chemical analysis of the sewage water and the effluent.*—

Samples were taken on 27th September 1948 and they were analysed with the following results:—

Chemical quantities given per 100,0.0 gallons.	Raw sewage (small)	Effluent (no small)
Total solids	153.0	157.0
Suspended solids	39.0	1.0
Chlorides as chlorine	28.4	38.3
Ammoniacal nitrogen	3.9	0.10
Alkaloid nitrogen	1.25	0.098
Oxygen absorbed	7.8	0.80
Nitric nitrogen	1.28	1.28
Oxygen absorbed	3.38	0.43
Fluorides	Nil.	Nil.
Biological oxygen demand	..	0.8
Qualitative nitrites	Nil.	Marked.

165. *Mode of disposal of grass.*—The sewage farm is divided into plots of about 2½ acres. Each plot is auctioned and the highest bidder gets it. The grass is to be sold at fixed rates. The bundles should not weigh less than 10 lb. and shall not be sold for more than two annas at the consumer's door.

166. *Yield of grass.*—Crop-cutting experiments were done in the year 1940-41 on 12½ cents plots. Eight cuttings were done in the same plot in the year and the yields were as follows:—

Duration of interval in days.	Date of cutting.	Quantity.
		LB.
—	12th April 1940	4,691
57	7th June 1940	5,495
48	26th July 1940	2,831 (sewage system failed).
50	15th September 1940	4,282
52	6th November 1940	4,223
53	29th December 1940	3,119
51	18th February 1941	5,361
40	30th March 1941	2,987
Total		32,987 lb. from 1/8th of an acre.

This yield works out to 117·8 tons to the acre.

167. *Daily outturn of grass.*—The daily outturn of grass amounts 28 tons. This will be sufficient fodder for 2,090 animals for a day at 30 lb. per animal.

168. *Washings of sewage grown crops.*—The washings of sewage grown crops grown in Madurai farm were found to be comparable to extremely polluted waters. Judging from the standards generally set for potable waters, the sewage grown vegetables, more especially those eaten in the raw state, appear to be unfit for human consumption.

169. *Amount of irrigation.*—For red gravelly soils with provisions for sub-soil drainage, roughly 15,000 gallons of raw sewage will be necessary per acre per day. This will amount to 3 inches of water per acre in 8 days.

170. *Financial returns.*—The revenue and expenditure figures for the last fifteen years from 1934-35 to 1948-49 are given below—

Year.	Revenue.	Expenditure.
	RS.	RS.
1934-35	2,964	5,801
1935-36	15,461	5,581
1936-37	12,252	4,304
1937-38	13,529	4,873
1938-39	13,356	4,224
1939-40	13,628	4,645
1940-41	14,376	5,843
1941-42	18,573	6,276
1942-43	18,252	5,990

Year.	Revenue.	Expenditure.
1943-44	28,800	1,910
1944-45	28,096	8,857
1945-46	34,472	10,881
1946-47	86,844	11,338 + includes Rs. 5,000 lease amount of extension lands.
1947-48	1,32,465 +	12,012
1948-49	1,40,000	12,000
1949-50	1,60,000 = (estimated)	12,000 = (extent 108 acres).

(Sewage is taken as free.)

The figures will illustrate how profitable it is to run sewage farms for grass. The revenue per acre worked out to about Rs. 3,800 in 1947-48 and it is on the increase. By selling the grass at 2 annas per 10 lb., the contractor is able to pay this amount. The cost of production works out to only about Rs. 1·1 per ton of green grass. With grass obtainable at this rate, dairy farming will be very economic.

171. *Milk supply scheme for Madras.*—Madras dumps daily into the sea about 27 million gallons of sewage water which contains about 5·4 tons combined nitrogen. The annual manurial value of this sewage water is equivalent to 10,000 tons of ammonium sulphate, valued at Rs. 30 lakhs. Proposals have been submitted from time to time to prevent this colossal waste of manure and to utilize it for growing crops. A few farms run in the past had become sewage sick and they were all abandoned. The latest scheme was to acquire 50 acres of land in Erukkenjeri village in Kodungur area, about 11 miles away from the city for an experimental sewage farm to determine the best methods of treating the local soil to overcome any possible sewage sickness that might set in the clayey soil. If the experiment proved successful, about 1,400 acres more of land were to be acquired in the locality. The Government Agricultural Chemist at Coimbatore analysed the soil and water samples sent from the site of the proposed sewage farm and pronounced the site unsuitable for the purpose of a sewage farm. All the same, the proposals were submitted to Government of India probably because as it was only an experimental farm. The idea was to raise only fodder in the area so that it may be given to the cows of the city and thereby increase the milk production. The Government of India said that this will not come under the Grow More Food Scheme. The Madras Government again addressed the Government of India and requested them to treat this scheme as a post-war development scheme. The cost of this experimental scheme came up to Rs. 2,80,000 non-recurring and Rs. 1,20,000 recurring.

An annual revenue of Rs. 30 to 40 thousand was expected. This scheme was examined by Dr. C. N. Acharya and he revised it into a bigger scheme involving growing paddy with sewage water over about 2,000 acres at a cost of Rs. 7.3 lakhs non recurring and Rs. 45,180 recurring. The annual revenue expected was Rs. 80,000. This scheme too was examined at a recent conference held by Sir Datar Singh and it was resolved to abandon this idea of growing paddy in the area with sewage water, as the soil which was stiff clay will become sewage sick in no time and as the paddy so grown will be destroyed by blast disease. A more composite scheme was suggested by Mr. V. S. Krishnaswamy to take this sewage water to the west of Madras to four or five localities where red soils occur and to utilize it for growing fodder for cattle. Even if these sites were a bit away it did not matter because on nitrogen manure alone we save 30 lakhs. First-class dairy farms were to be run either by the Government or by the Corporation adjacent to these fodder farms. As the quantity of sewage comes to about 27 million gallons per day on the experience gained at Madurai, it will be possible to grow fodder over about 2,000 acres. Besides this, considerable quantities of effluent water which is also good manure will become available and this can be discharged into adjacent water storage to be utilized for irrigation. Out of these 2,000 acres of sewage farm, 200,000 tons of fodder may be expected per annum and this will be sufficient feed for nearly 40,900 heads of cattle allowing 30 lb. ration of green grass per day per animal. So half the area, namely, 1,000 acres will give all the fodder necessary for 20,000 cattle which can easily meet the milk demand of the city of Madras. If the farms are dispersed in five or six localities, management will be easier and it is also good to have such dispersion to avoid undesirable concentration of labour, etc. The balance of 1,000 acres and the effluent water may be utilized for growing sugarcane or any other crop. With a fodder farm producing green fodder at about Re. 1-1-0 per ton next door, any dairy must pay. Such an organization will automatically solve many of our ills due to keeping the milking animals in congested localities inside Madras. To develop rapidly such a big dairy, cross breeds may have to be used in the beginning to be replaced later on by indigenous cows and buffaloes bred to yield large quantities of milk. Sir Datar Singh promised to send an expert from Bombay to help the Madras officials in preparing a modified sewage farm scheme on the lines mentioned in this paragraph. The Hon'ble Minister for Forests and Agriculture who was present said that even if the scheme were to cost much, it should not deter us as the proposal was an essential one.

172. *Opening of ranches.*—As adjuncts to these dairy farms, there should be grass lands where the dry cows and calves may be ranched. Such lands should be conveniently located with

reference to road or rail and there should be no need for cattle to trek over miles and miles. It will be possible to get such grasslands near Madras now that zamindari forests also are reverting to Government.

173. *Necessity for an officer on special duty for working out the details of the Madras Milk Scheme.*—To select suitable sites within reasonable distance of Madras for locating sewage farms and to work out the engineering details and to prepare estimates, competent engineer with qualifications in sanitary engineering may have to be appointed. He should be made responsible for the job. If necessary, he must be prepared to execute the scheme. This officer will have to work in close collaboration with the Agricultural department in the preliminary stages to select suitable sites for sewage farms.

174. *Organization of the milk supply to Madras City.*—If so advised, further action may be taken on the Milk Plan for the City prepared by Mr. Murari. Only thing is his dairy farms should be located very near the proposed sewage fodder farms, the sites for which will no doubt be selected soon.

175. *Milk supply scheme for Madurai.*—In Madurai with a ready made sewage fodder farm, it is surprising that a dairy farm has not yet been started by the municipality or the Government. It will be easy to get poramboke lands near Madurai for ranching dry dairy cows and calves. It is suggested that a dairy farm scheme may be prepared for Madurai town utilizing the fodder from the present sewage farm.

176. *Sewage disposal at Coimbatore.*—It is understood that, in Coimbatore, the underground drainage scheme has been partially executed and that the sewage water is dumped into the marshy land between Coimbatore and Podanur. It is suggested that, if at all possible, the drainage scheme for the rest of the area of the town be modified so that the water may be utilized for running a sewage farm growing fodder.

177. *Other urban centres.*—It is suggested that, in all drainage schemes, under execution or proposed to be executed and in other schemes relating either to the disposal of sullage water or conservancy and nightsoil material, provision will be made for raising fodder farms so that at the end of a reasonable period even though dairy farms are not started at least green fodder will be available to the milch cattle of the place. When once fodder farms are formed dairy farms will follow.

178. *Possibility of private agencies running dairy farms near urban centres.*—It may be just possible that private parties or limited concerns will be willing to run dairy farms near urban centres provided they are given monopoly for supplying milk to that

centre and other facilities for raising fodder and for ranching their dry animals. The railways also should be requested to quote concessional rates for transporting cattle. Such parties should be given all reasonable encouragement provided they agree to sell the milk at rates fixed by the Government from time to time. Each case will no doubt be dealt with on its merits, but in no case should a private commercial dairy farm be allowed to commence work, unless it gets a certificate from the Director of Animal Husbandry, that its method of working is technically sound and that it has technically qualified personnel to manage the dairy.

179. *Dairy farms will also supply "Seed" Bulls.*—These dairy farms proposed to be started will, in course of time, supply "Seed Bulls" for distribution to rural centres.

180. *Government livestock farms.*—More livestock farms have to be formed in the State to supply sufficient number of "Seed Bulls." The present supply is not at all sufficient. It is hoped that the Chinthaladevi farm of Nellore will begin to function soon. In addition to this, arrangements for artificial insemination will have to be made extensively to cope up with the increasing demand for grand-up animals. Private cattle-breeders deserve reasonable encouragement based on the number of approved breeding bulls they market each year. In seasons of scarcity, they may require special help from the Government and it is hoped that such help will not be denied to them.

181. *Possibility of opening a big cattle farm on the borders of Salem and South Arcot districts and elsewhere.*—Near the 42nd mile from Salem on the Salem-Cuddalore Trunk Road near the banks of Vellar, the road to Viraganur takes off. On either side of this road and also across the Vellar and also to the north of the Trunk road, considerable extent of poramboke lands are reported to occur. Sub-soil water level is also fairly high in that region. This tract is considered suitable for locating a big cattle farm occupying about 10,000 acres or so. No doubt similar areas will be available throughout the State. It is suggested that all such big compact areas are set apart for locating big cattle farms.

182. *Possibility of creating milk pockets in the State.*—The grass hills of Anamalais in Coimbatore district offer possibilities for establishing a big dairy farm and for creating what are known as 'milk pockets.' The locality has an equable climate and good milk yielding strains of cattle may be bred there. The milk produced may be disposed of to estate labour and the excess may be sent to Pollachi or Coimbatore. Similarly the Nilgiris Downs as have not been taken up for tree planting may be set apart for locating big dairy farms. Excess of milk produced here may be

disposed of in markets in Malabar or at Coimbatore. If so decided, the milk produced in these dairies may also be converted into condensed milk or powder.

CHAPTER XII

PROPOSED ORGANIZATION.

183. *Special organization necessary.*—So far all the important aspects of the problems referred to us for investigation have been examined. Now the nature of the organization necessary for giving effect to the various suggestions made in this report has to be discussed.

For dealing with fodder scarcity, the Board of Revenue suggested the setting up of a State fodder organization. Another suggestion was the constitution of an expert committee called the "Milk Board" which will look after the work of the Provincial Fodder Grazing Committee and the contemplated Provincial Land Utilization Board and also examine the question of increasing the productivity of the land, elimination of fodder scarcity and all aspects of milk production, distribution, etc. To examine these problems, a Forest and an Agricultural officer were appointed. There was also a suggestion that a Veterinary officer should be associated with these officers but it was not approved. The fact that officers of three departments were thought of to examine these problems shows that only particular aspects of the problems are dealt with by particular departments. So much so co-ordinated long-range schemes of development are not possible and piecemeal methods are adopted in dealing with subjects common to many departments. There is great isolation of departmental activities. Cattle feeding and breeding necessitates the closest co-operation between the Animal Husbandry, Agricultural and Forest departments. Dairying involves in addition a number of problems connected with marketing and co-operation as well as public health considerations. Some of the subjects dealt with in this report are not dealt with by any department. In a recent conference regarding the salvage of cattle, the Animal Husbandry department, the Co-operative department and the Agricultural department had all sent short accounts of the salvaging schemes submitted by them. This reveals the possibility of three departments doing the same type of work. It also reveals the possibility of none of the departments taking up the initiative in tackling a difficult problem. Fodder problem is one such. No particular department can deal with all aspects of this problem, and so the problem has not been handled at all adequately and viewed from the correct perspective. Fodder, milk supply and land utilization problems appear to be widely different but there is an essential unity in all the three subjects. Proper land utilization means better soil and moisture conservation and better conservation will mean more fodder and more fodder will mean more milk. Unless big problems like this are approached from all angles

we may not succeed in our endeavours to resolve them. Therefore, in our opinion, there should be a new technical organization which can deal effectively with the problems discussed in this report. This department will be in charge of all the poramboke and the waste lands under the control of the Government. They should be in a position to carry out the various works suggested in this report. They should take over the management of marginal forests and marginal lands and also look after crop planning. They should be able to raise fuel and fodder reserves and manage pasture lands. The Royal Commission on Agriculture long ago suggested the appointment of separate Forest officers to be in charge of minor forests and fuel plantations, village wood lands and waste lands now chiefly used for grazing and often included under unclassified forests. These officers should not only conserve and develop the natural resources of such area, should also make experiments in the sylviculture and in the improvement of grazing areas. To foster closer touch between the Forest and Agricultural departments, it was thought that it will be an advantage if short courses were instituted at the Agricultural College for newly recruited Forest officers. Further a Forest officer being posted to the new minor forest divisions should, we consider, be attached for a period of not less than three months to the headquarters of the State Agricultural departments with the object of making himself thoroughly acquainted with the view of the department as to the needs of the cultivators in the vicinity of the forest which he is to administer and in the State generally. In the light of the discussions made above, we recommend the creation of a new department called the "Department of Land Conservation." It will have a Director of Land Conservation, Assistant Directors of Land Conservation and Deputy Directors of Land Conservation. The Assistant Directors of Land Conservation and Deputy Directors of Land Conservation will be in charge of the district administration. Their principal job will be the management of all Government lands not under Forest department, and developing their fuel and fodder output. They will also manage the grass farms proposed to be formed and the livestock farms in addition to managing fodder plantations proposed to be raised near urban centres. Later on marginal forests and marginal lands will also have to be managed by them. Demonstrations in mixed farming will also be under them. In addition to the above they will be in charge of the enforcement of crop planning proposed in the report and the protection of the tract entrusted to them. Soil conservation will also be one of their jobs. To assist them in these several works, the Assistant Directors of Land Conservation will have Inspectors or Supervisors to help them. There will also be inferior staff, clerks, etc., to assist. The Deputy Directors of Land Conservation will be regional officers and the Director will be the head of the department. These officers should possess technical qualifications and experience in Agriculture and Forestry.

In the initial stages the personnel will mainly be recruited from the Agricultural and Forest departments. Later on, when live-stock is attached to the grass farms, personnel from Animal Husbandry department may have to be recruited. The future recruits both for the gazetted and non-gazetted stage will have to be trained with a special curriculum which will include basic knowledge of Agriculture, Animal Husbandry and Forestry.

We consider that only by having a separate department like this, to deal with all problems relating to land conservation and development, will our progress as a nation lie.

184. Acknowledgments.—We take this opportunity of thanking all the officers of the Agriculture, Animal Husbandry, Co-operative, Forest, Revenue departments and the numerous other gentlemen for the very valuable help rendered to us in producing this report.

SUMMARY OF SUGGESTIONS AND RECOMMENDATIONS.

1. The following is the summary of suggestions made regarding reserved forests which, if adopted, will make for better grazing for a larger number of cattle.

(1) Gradual increase of grazing fees till the number of reserve going cattle comes down to what the forests can bear;

(2) inspection of present rotational grazing blocks and closing those which do not conform to real rotational grazing;

(3) bringing under scientific management and treatment suitable grass lands;

(4) appointment of a Special Forest Officer with training in Agriculture to conduct research experiments in the management of grass lands and in breeding suitable herbage and forage plants under forest conditions;

(5) developing penning system to distribute grazing to the interior forests also;

(6) opening of a grass farm at Gazulapalle in Kurnool district for meeting the military demand for grass ordinarily and for meeting in emergency the demand from the civilian population;

(7) revision of estimates of supply of grass from the different reserves of Anantapur and Bellary districts including the panchayat forests which reverted recently;

(8) utilizing the proposed pens in Nallamalais during famine period for keeping cattle brought or bought from famine zones;

(9) popularising the manufacture of silage and hay;

2. The following are the suggestions relating to Government lands outside reserved forests :—

(1) To prohibit under heavy penalties further extension of cultivation in the *poramboke* and other lands at the disposal of Government; and

(2) to prepare plans of management for the *poramboke*, keeping in mind the following objects of managements :—

(a) to preserve the existing tree growth in them;

(b) to create fuel and fodder reserves in them where possible by the *Kumri* method and to manage them scientifically as pasture lands;

(c) to manage the rest of the *poramboke* lands as natural pastures taking such of the soil and water conservation measures as are necessary to improve their pasture value;

(d) to grow, where facilities for irrigation exist at present, or can be created at low cost, perennial fodders of high nutritive value like Guinea grass, Napier Grass, Rhodes grass, Lucerne, Berseem, Sunnhemp, Pillipesara; and

(e) to form special grass farms in accessible places where fodder will be cut in the appropriate season, if possible, by mechanised methods and preserved as silage or hay as a summer feed or as a famine reserve.

3. Regarding current fallows, the first suggestion is to revert them to pasture without giving room to controversy or opposition, the procedure being settled in consultation with the Board of Revenue. If this is not practicable, steps should be taken to reclaim them for continuous farming by adopting mixed farming practices.

4. The following are the suggestions regarding mixed farming :—

(1) Propaganda, mentioning the advantages of mixed farming and use of compost manure;

(2) Organizing demonstrations of mixed farming in marginal and sub-marginal lands of the ryots. Garden lands also should be included in such demonstrations;

(3) To demonstrate the possibility of growing fodder crops in paddy lands without in any way diminishing the yield of paddy; and

(4) Organization of demonstration in all districts, inducing big ryots also to adopt mixed farming methods.

5. In the Ceded districts, one year's reserve stock of fodder will have to be built up gradually by growing more fodder crops than necessary in the initial stages. This reserve fodder is better kept as silage.

6. For improving the condition of cattle in rice tracts, the Animal Husbandry department may consider the suitability of feeding animals on the rations suggested.

7. The practice of giving bone-meal and larger doses of salt should be popularised by propaganda in paddy tracts, as rice straw is a very poor fodder.

8. The quality of cholam and cumbu straws may be improved by suitable breeding.

9. Berseem may be tried extensively in the State wherever facilities for irrigation exist.

10. The deep-rooted redgram may be introduced in the drier districts of our State.

11. Steps should be taken to increase the area under Lucerne, Pillipesara and Sunhemp near urban centres.

12. A detailed survey of the nutritional deficiencies of the different tracts of the State may be taken up.

13. When reseeded pastures, Kolukattai grass, may be given extensive trial.

14. Guinea grass slips may be planted alongside of water courses, irrigation channels and field bunds in the State.

15. The introduction, in suitable areas of the dry Napier grass is suggested.

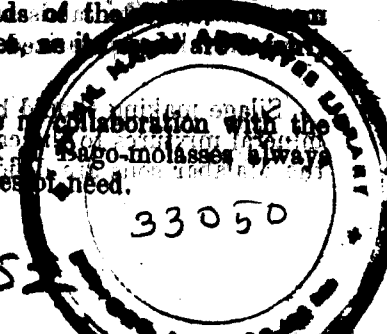
16. The palatability and digestibility tests may be conducted with *Panicum antidotale* at various stages of its growth.

17. In the fuel and fodder plantations proposed to be raised in the *Poramboke*, only such trees as have both fuel and fodder value may be raised. Such trees may be also raised alongside roads, canal banks, and in other places where concentrated methods of planting may not be possible. A start should be made in the Arantapur and Bellary districts, especially in those taluks which are susceptible to famine.

18. The Chemical composition of the leaves of the more important fodder yielding trees may have to be determined, and their digestible nutrients worked out.

19. Steps must be taken to introduce a few *Acacia leucophloea* and other suitable trees in the dry lands of the State. Such trees may be also grown in suitable places, as they are a rich source of protein and calcium.

20. Steps should be taken in this State in collaboration with the sugar mills to have an emergency stock of sugar molasses always ready for rushing to scarcity areas in times of need.



21. To increase the fodder supply from private lands, the following lines of approach may be made:—

(1) Adoption of scientific and intensive methods of cultivation to increase the grain outturn and incidentally increase the quantity of crop residue;

(2) inclusion of a regular fodder crop in the cropping cycle; and

(3) growing a pure fodder *cum* green manure crop in a portion of the individual's holding.

22. *Tungabhadra Project area.*—As the proposed crop rotations will result in heavy fodder deficit, it is suggested that the growing of a pure fodder crop over a portion of the project area may be borne in mind when finalizing the cropping practice.

23. *Tanjore delta.*—The practice of growing Pillipesara and Sunnhemp should be extended by suitable propaganda. *Sesbania grandiflora* (Agathi) may be grown. The possibility of giving a small quantity of water for the green manure crop, if the summer rains fail, may be considered.

24. *Cauvery-Mettur Project area.*—It is suggested that the Cauvery-Mettur Project area be treated as a single crop paddy area till the soil is completely formed. It is suggested that the irrigation system may be suitably modified to permit the growing of green manure and fodder crops, in the beginning of the growing season, and to grow paddy after the 15th August or so. If it is not considered desirable to try this suggestion over the whole of the project area, it may be tried at least over a section of the project area.

25. *Malabar.*—It is suggested that a Legume fodder crop may be grown after paddy in single crop wet lands of Malabar. The possibility of growing a green manure *cum* fodder crop in Modan lands in the areas when paddy is not grown should be seriously considered. It is suggested that a few demonstration farms should be opened. Any help to be given to the ryots who wish to take to this cultivation should not be in cash but should be limited to free seed and probable remission of tax when the land is with a green manure crop. It is suggested that a systematic attempt should be made to grow mostly fodder shrubs in Government and private lands and that Guinea grass and dry Napier grass may be popularized.

Silage making should be taken up seriously in Malabar. Giving mineral mixtures to the cattle of Malabar should be popularized, as the Malabar soils are deficient in calcium and phosphorous.

26. *Preparation of Agricultural Working Plans.*—Proper working plans for the agricultural management of the State have to be prepared to aim at producing on a sustained basis the different crops in the lands most suited to them at economic costs so that maximum production may be achieved at the minimum cost. Such plans should include provisions for production and supply of suitable manures also. They should be on a self-sufficient regional basis to reduce transport of products to the minimum. Above all, the plan should aim at giving the maximum return to the ryot. It is suggested that a Senior Deputy Director of Agriculture and two or three gazetted officers of the Agriculture department, with adequate subordinate staff, may be engaged on producing practicable plans for the different blocks of the State within a reasonable time. When the plans are approved, to enforce them, legislative sanction will be necessary.

27. A study of agrostology and research on animal nutrition are important.

28. To improve the village cattle, it is suggested that only selected bulls are allowed to breed on selected cows. These animals should be specially looked after and fed adequately and properly.

29. The possibility of using guntaka and gorru in the black and red soil areas of the south should be considered.

30. The conservation of fodder in the form of hay and silage is suggested as also the use of chaff cutters to chop into small bits woody stems of cholam and cumbu straw.

31. Rest stations may be opened at regular intervals of 10 miles or so along the main migration routes of coastal cattle to Cuddapah and Karnool districts. Adequate water sources should be also provided in such rest stations.

32. Goats.—Legislation seems to be necessary to minimize the depredation of goats. The keeping of milch goats in Malabar should be encouraged.

33. *Land utilization.*—The recommendations of the expert committee of the Government of India regarding this State should be examined and implemented.

34. Rural milk supply can be increased only by better feeding, for which adequate steps have already been suggested.

35. The following suggestions have been made for improving urban milk supplies:—

(1) Raising of green fodders with sewage, sullage and compost materials near urban centres and supplying the same to the urban cattle.

(2) Opening of dairy farms by Government or local bodies as adjuncts to the above fodder farms.

(3) Gradual prohibition of sale of milk in urban centres with the development of the dairy farms.

(4) Opening of ranches in accessible places for herding the dry cattle.

(5) Supply of only pasteurised milk from the dairy farms.

36. *Milk supply scheme for Madras.*—The following suggestions have been made :—

(1) Opening of sewage farms for growing green fodder in four or five localities, the total extent being 1,000 acres.

(2) Opening of ranches in accessible places for herding dry cows and calves.

(3) Appointment of a Sanitary Engineer on special duty to work out the details and to prepare the estimates for the proposed sewage farms.

37. The opening of a dairy farm has been suggested for Madurai town.

38. The modification of plans of Coimbatore underground drainage system to permit the formation of sewage farms has been suggested.

39. In all schemes of drainage and disposal of conservancy material, provision should be made for raising fodder farms in conjunction with them.

40. The opening of private dairy farms should be encouraged and facilities afforded to them.

41. The opening of more livestock farms is necessary.

42. Dairy farms in the grass hills and the downs of Nilgiris may be started.

43. Creation of a new department of land conservation to deal with all aspects of fodder, milk production and land utilization problem has been suggested.

APPENDIX I.

QUESTIONS ISSUED IN CONNECTION WITH THIS INVESTIGATION.

1. Cattle population of the district—
Cows, bullocks, he-buffaloes, she-buffaloes, sheep, goats and horses.

2. Total quantity of fodder required to feed the above.

3. Sources of present fodder supply—approximate quantities in tons, from each source.

4. Extent in area cultivated with cattle fodders like fodder, cholam, Napier grass, Guinea grass, Legumes like Pillipesara, Sunnhemp, Lucerne, etc.

5. Yield of green fodder in tons per acre from item 4.

6. Are the fodder crops grown in rotation with other crops or as a mixture with other crops? Brief details regarding the time of sowing the fodder crop and its harvest and the cultivation practices adopted, may be given.

7. If fodder crops are not grown at present, will the ryots of the district be growing such fodder crops which have also green manure value like Pillipesara, Sunnhemp, etc.? If so, what is the scope.

8. If the district is deficit in cattle fodder in normal years, the exact deficit, in tons may be given.

9. How is the fodder deficit met during (a) normal years and (b) during famine years?

10. If the district is surplus in fodder, how is the surplus disposed of?

11. What are the requirements of the district in concentrates?

(1) Oilcake (cattlefeed).

(2) Cotton seed (cattlefeed).

(3) Bran.

12. How are the requirements met and to which places are the surplus quantities, if any, are despatched?

13. Is the district self-sufficient regarding work animals for agricultural purposes? If not, how is the deficiency made up?

14. Are there any special local breeds of cattle in the district? If so their names may be given. Are there any professional cattle breeders in the district?

15. What is the demand and supply of milk in the municipal and panchayat towns in the district. What are the ruling prices for unadulterated milk and milk products in such towns? (Madras measures and units may be adopted as the units.)

16. Are milk and milk products like butter and ghee exported from or imported into the district? If so the details may be given.

17. How do the panchayats and municipalities of the district dispose at present the conservancy materials? Is any composting done?

18. Are any sewage farms run in the district either by local or other bodies? If so the details regarding the extent of the farm, the crops grown and the quantity of yields obtained may be given.

19. If the municipalities and panchayats grow green cattle fodder like Guinea grass, Rhodes grass and Sunnhemp. Legumes like lucerne, Pillipesara, will there be demand for them from urban cattle owners?

20. Is there demand in the urban centres of the district for more milk? If so the quantities may be given.

21. Is the present method of land management and assignment of lands working satisfactorily from the point of view of conservation of soil and moisture in the district?

22. What steps are being taken to prevent the breaking up of steep lands for cultivation?

23. Will it make for soil and moisture conservation if sivayijama cultivation is prohibited in the district?

24. Will it make for better land utilization if management of all lands, at the disposal of Government is vested in a special board consisting of technical officers?

25. Will it be advisable to get legislative sanction for enforcing the adoption of soil conservation measure by ryots in lands already under cultivation and for adopting certain crop rotations which are considered to be necessary in the interest of the nation?

26. What is the extent of land in the district which is not cultivated regularly every year (marginal and submarginal land—current fallows)?

27. Will it be advisable to resume such marginal lands which are not cultivated for two successive years and manage them as pasture lands for the livestock of the locality?

General.—Any general practicable suggestions for increasing cattle fodder production in the district, and for increasing milk supply in urban centres will be welcome.

APPENDIX II.

SOME COMMON FODDER GRASSES AND CULTIVATED FODDER CROPS OF THE MADRAS STATE.

Indigenous grasses.

1. *Amphilophis pertusa*, Stapf:

Tel.: Gara gaddi, Sanu gaddi; Tam.: Chinna Karai pullu; Kan.: Karaikanda hullu.

A perennial, runner grass growing up to 2 to 3 feet in height and occurring in most districts. At Coimbatore under rainfed conditions it has yielded upto 8,000 lb. per acre per year. It comes up well in semi-dry conditions and spreads to form a mattress. It is a good pasture grass readily grazed by cattle.

2. *Andropogon pumilus*, Roxb.

Tel.: Yerra gaddi.

A perennial grass growing upto 2-3 feet in large clumps. Occurs in most districts in semi-dry situations, especially in black soils. A good fodder grass and readily grazed by cattle.

3. *Apluda cristata*, L.H. Gururua.

Tam.: Manda pillu, Mungil pillu; Kan.: Akkuhullu.

An annual grass occurring in most districts and growing up to 3 feet. Thrives in dry localities. Relished by cattle before flowering. After flowering it becomes less palatable.

4. *Alloterpis cimicina*, Stapf.

Kan.: Niru sajjai hullu.

An annual growing up to 3 feet. Occurs in all districts and readily grazed by cattle.

5. *Brachiaria eruciformis*, Griseb.

Tel.: Domakalu gaddi.

An annual growing up to 2 feet. Occurs in most districts especially in black soils. Readily grazed by cattle.

6. *Brachiaria distachya*, Stapf.

Tel.: Koranna gaddi, Kan.: Hambu Haraka Hullu.

An annual growing up to 2 feet. Occurs in most districts especially in favourable localities; readily eaten by cattle.

7. *Brachiaria ramosa*, Stapf.

Tel.: Eduru gaddi; Kan.: Kadubaragu hullu.

A robust annual occurring in most districts, especially in red soils. Grows up to 3 feet; readily grazed by cattle.

8. *Cenchrus ciliaris*, L.

Tam.: Kolukattai pillu.

This is a rhizomatous perennial grass growing up to 3 feet. The arial shoots may dry up during severe summer months, but the underground rhizomes keep alive. It comes up in dry situations, but can make a luxuriant growth only during the monsoon period. It is the chief fodder grass of the Kangayam tract and is regularly sown in pasture lands in this area. Seed rate 10-15 lb. per acre. Under rainfed conditions at Coimbatore this grass has yielded up to 21,000 lb. per acre in an year. Under more favourable conditions it yields up to 40,000 lb. and gives 3-4 cuttings in an year. It is worth trying this grass in other areas.

9. *Cenchrus setigerus*, Vahl.

Tam.: Karuppu kolakattai.

Similar to *c. ciliaris* but grows less tall and the output of fodder is also less. But this is more drought resistant than the former.

10. *Chionachne Konigii* Thw.

Tel.: Gela gaddi, Kan.: Suku dabha.

A tall growing perennial robust grass attaining a height up to 5 feet under favourable conditions. At Coimbatore under rainfed conditions it has yielded up to 15,000 lb. per acre per year. It is relished by cattle and is cultivated on a small scale by ryots in Tanuku in Godavari district.

11. *Chionachne semiteres*, C.E.C. Fisher.

A tall growing perennial reaching a height of 4-5 feet under favourable conditions. At Coimbatore under rainfed conditions it has given 15,000 lb. an acre in one or two cuttings per year. It is relished by cattle when young. When it gets old, the grass becomes a little coarse. Does not occur freely in nature.

12. *Chloris Bournei*, Rang and Tad.

Tel.: Pedda uppu gaddi.

A perennial growing up to 3-4 feet. Occurs in many districts especially in black soils. Yields very heavily under favourable conditions. At Coimbatore an yield of 56,400 lb. per acre in 3-4 cuttings has been obtained. It thrives well in semi-dry situations and tolerates alkalinity. Relished by cattle before flowering. After flowering, it becomes less palatable.

13. *Choloris barbata*, SW.

Tel.: Uppu gaddi, Tam.: Karuthu pullu; Kan. Henu machada kadu hullu.

A perennial grass similar to above, but less robust and less tall. But its occurrence is more cosmopolitan.

14. *Choloris incompleta*, Roth.

Tel.: Kanthara gaddi; Kan.: Melamalai hullu.

A perennial grass similar to above, but less robust and less cosmopolitan. Grazed by cattle when young.

15. *Chloris polystachya*, Roxb.

Occurs in semi-dry situations. Not a common grass.

16. *Chrysopogon montanus*, Trin.

Tel.: Gurra bathokelu; Kan.: Chello san kanni.

A perennial grass growing up to 23 feet. A grass which thrives well in dry situations especially in gravelly and laterite soils of hilly and forest areas. Occurs in most districts. It is relished by cattle but the forage output is low.

17. *Chrysopogon orientalis*, A. Camus.

A perennial grass similar to above and closely associated with it.

18. *Cymbopogon coloratus*, Stapf.

Tel.: Botha gaddi; Tam.: Manda pillu; Kan.: Hadhai hullu.

A perennial grass growing in clumps, grows up to 5 feet. Occurs in most districts especially on the open hill slopes. Grazed by cattle only when young.

19. *Cymbopogon Gidarba*, Haines.

A perennial grass similar to the above. The only *Cymbopogon* without the smell.

20. *Cynodon Dactylon*, Pers.

Tel.: Garika; Tam.: Arugam pillu; Hariali.

A perennial creeping grass growing up to 2 feet. It spreads and perennates through underground stems. Once established, it is difficult to eradicate it. It is an excellent fodder for cattle and horses and highly nutritious. It occurs in all places and comes up well specially in black soils. In cultivated areas, it is a bad weed.

21. *Cynodon Barberi*, Rang and Tad.

Tel.: Chinna garika; Sanna ootla kasuvu; Kan.: Melgarika hullu.

Similar to the above but less robust and tall. Occurs in semi-dry situations in most districts.

22. *Dactyloctenium aegyptium*, Beauv.

Tel.: Gurrapu gaddi.

A quick growing annual grass, highly spreading and attaining a height of about 1 foot. Occurs in most districts under semi-dry conditions. A good fodder grass.

23. *Dichanthium annulatum*, Stapf.

Tel.: Molava gaddi.

A perennial, much spreading grass growing up to 3-4 feet. Occurs throughout the State, especially under more favourable situations and prefers moist conditions. One of the best fodder grasses and very much relished by cattle.

24. *Dichanthium caricosum*, A. Camus.

Tel.: Molava gaddi; Kan.: Urukkun hullu.

Similar to the above. An excellent fodder grass.

25. *Digitaria marginata*, Link.

Tam.: Arisipillu.

Slender annual growing up to 2 feet and occurring in most districts especially in light soils. Readily grazed by cattle.

26. *Digitaria marginata*, link var. *Fimbriata* Stapf.

Tel.: Pedda ootla gaddi; Tam.: Arisi pullu.

Similar to the above and more cosmopolitan in occurrence.

27. *Digitaria pedicellaris* Pr.

Similar to the above but less common. Cattle readily grass the grass.

28. *Dinebra retroflexa*, Pans.

Tel.: Wadata toka gaddi; Kan.: Naribalada gandu hullu.

A quick growing annual growing up to 2 feet. Occurs in all districts especially in black and loamy soils. A good fodder grass.

29. *Echinochloa colona*, Link.

Tel.: Otha gaddi; Tam.: Karum pul.

A quick growing annual growing to 3 feet in height occurs in most districts especially under moist situations. Readily eaten by cattle.

30. *Eriochloa procera*, C.E. Hubb.

Tam.: Tandambaram pillu.

A slender annual grass growing up to 3 feet in height. Occurs in all districts in wet situations. Readily grazed by cattle.

31. *Enteropogon monostachyos*, K. Schum.

Tam.: Kammi pillu.

A slender, densely tufted perennial grass growing up to 3 feet. Under rainfed conditions it has yielded up to 13,000 lb. in two cuttings in one year.

32. *Eremopogon foveolatus*, Stapf.

A slender, much tillered and tufted perennial grass growing up to 2-3 feet. Under rainfed conditions in Coimbatore it has yielded up to 12,000 lb. an acre in two cuttings per year. It comes up well in dry situations in all districts. A good fodder grass.

33. *Eragrostis plumosa*, Link.

Tel.: Goobba gaddi; Kan.: Dodda purlai hullu.

An annual growing up to 2 feet. Occurs in all districts in semi-dry situations. Readily grazed by cattle.

34. *Eragrostis poaeoides*, Beauv.

Tel.: Goobba gaddi; Kan.: Dodda purlai hullu.

Similar to above.

35. *Eragrostis cilianensis*, Link.

Tel.: Pedda chitla gaddi.

Similar to above.

36. *Eragrostis bifaria* W.

Tel.: Nakka piehu kasavu; Kan.: Kodimara hullu.

Similar to above.

37. *Eragrostis diarrhena*, Stend.

A robust perennial occurs in all districts in wet situations. Specially paddy bunds. A fair fodder.

38. *Eragrostis gangetica*, Stend.

Similar to above but an annual.

39. *Eleusine indica*, Gærtn.

Tel.: Thippa ragi.

A slender annual growing up to 1-2 feet occurs in most districts under semi-dry conditions.

40. *Heteropogon contortus*, Beauv.

Eng.: Spear grass; Tel.: Pandi bellam; Tam.: Oosi pullu; Kan.: Sunkari hullu.

A quick growing perennial growing up to 2-4 feet. It occurs in all districts and is the dominant species in many forest pasture lands of South India. It is a good fodder and also makes good hay. It

comes very well in dry situation. Cattle relish this grass especially before flowering. The spear like arms are a draw back for this very useful grass.

41. *Iseilema laxum*, Hack.

Tel.: Errachengali; Tam.: Tena nari pullu.

A much tillered, robust perennial growing up to 4 feet. The most important grass of the Ongole tract where the Nellore breed of cattle are bred. Thrives in black and heavy soils. An excellent fodder grass.

42. *Iseilema anthephoroides*, Hack.

Tel.: Chengali.

Similar to the above but less robust.

43. *Iseilema prostratum*, And.

Tel.: Yerrakalakasuvu.

Similar to above.

44. *Ischaemum pilosum*, Hack.

Tel.: Kundra gaddi.

A robust perennial growing up to 3 feet, occurs in most districts especially in black soils, readily eaten by cattle when young.

45. *Ischaemum rugosum*, Salisb.

Tam.: Kadukken pillu.

A perennial growing up to 3 feet. Occurs in most districts. Eaten by cattle and horses when young.

46. *Leptochloa obtusiflora*, Hochst.

A quick growing, erect perennial reaching up to 4 feet. Has only a limited distribution in the State. It contains a small amount of prucic acid, but this dose is not considered harmful to cattle.

47. *Leptochloa chinensis*, Nua.

Tel.: Cheepura gaddi.

A slender annual growing up to 2-3 feet. Occurs in most districts especially under moist situations.

48. *Leptochloa filiformis*, Roem.

Similar to the above.

49. *Panicum repens*, Linn.

Tel.: Ladda gaddi; Tam.: Inji pillu; Kan.: Soni hullu. The ginger grass.

A creeping perennial growing up to 1-2 feet occurs in all districts in most localities especially on paddy bunds. It is much relished by cattle and is believed to stimulate milk yields.

50. *Paspalum scrobiculatum*, L.

Tel.: Arika; Tam.: Varagu.

The straw of the cultivated type makes a good fodder. The wild type is a slender annual occurring in all districts in moist situations. Grows up to 2-3 feet. It is safer to feed the cattle without the grains,

as otherwise, the hydrocyanic acid in them is reported to kill even elephants.

51. *Paspalidium flavidum*, Camus.

Tel.: Uda gaddi; Tam.: Arisi pillu.

A prostrate annual growing up to 1 foot and occurring in all districts in moist places. Readily eaten by cattle.

52. *Perotis indica*, O.K.M.

Tel.: Nakka Thoka gaddi; Tam.: Nari val pillu; Kan.: Narimeesai hullu.

A slender annual growing up to 1 foot in height. Occurs in all districts in dry situations. The leaf growth is very little and cattle nibble at it.

53. *Schima nervosum*, Stapf.

Tel.: Nendra gaddi; Tam.: Kuraitti; Kan.: Sinna Shadai hullu.

A perennial, highly tillering clump grass, occurring throughout the Deccan, particularly in Chittoor, Coimbatore, Guntur, Krishna and Nellore districts. Prefers shady areas and is one of the best fodder grasses under rainfed conditions, it has yielded about 10,000 lb. per acre in 2 cuttings in an year.

54. *Setaria pallidifusa*, Stapf.

Tel.: Nakka Korra.

An annual occurring in all districts in semi-dry areas. Grows up to 2-3 feet and is readily grazed by cattle.

55. *Setaria verticillata*, Beauv.

Tel.: Aranta, Kan.: Samma anta Purlai hullu.

An annual occurring in all districts. Grows up to 2-3 feet. Eaten by cattle before flowering. On flowering sharp bristles of the spike cause annoyance to the cattle.

56. *Saccolapis curvata*, Chose.

An annual growing up to 2-3 feet. Occurs in marshy areas in many places. Relished by cattle.

57. *Sporobolus coromandalianus*, Kunth.

Kan.: Naribalada hemmu hullu.

An annual growing up to 1 foot. A common grass on the pastures in all districts, but a poor fodder.

58. *Trachys muricata*, Stend.

A slender procumbent annual occurring in most districts in moist and favourable situations. It is readily eaten by cattle.

59. *Tragus biflorus*, Schult.

Tam.: Othu pullu.

A slender annual, growing to $\frac{1}{2}$ -1 foot, common in many places, in semi-dry areas. Not readily grazed by cattle because of the spiny spikelets.

60. *Urochloa reptans*, Stapf.

Tel.: Chinna chippari; Tam.: Shani pillu.

A quick growing and much spreading annual coming throughout the State in moist situations and cultivated fields. Relished by cattle.

61. *Urochloa panicoides*, Beauv.

Tel.: Pedda chippari.

Similar to the above but more robust, very much relished by cattle.

Exotic grasses.

1. *Bracharia mutica*, Stapf.

Eng.: Buffalo grass.

A native of America and West Africa. A perennial with good vegetative growth. Comes up well in marshy and wet areas and grows up to 3 feet high. An excellent fodder.

2. *Chloris Guayana*, Kunth.

Eng.: Rhodes grass.

A native of West Africa. A perennial growing up to 4-5 feet. It is raised under irrigation and yields from 20-30 tons of green fodder in one year per acre in 6-8 cuttings. It is extremely popular at Hosur (Live Stock Research Station).

3. *Cynodon plectostachyum*, Pilger.

Eng.: Giant star grass.

A native of Africa. A vigorous, perennial runner. It spreads rapidly. A single plant was noted to put forth spreading shoots each more than 20 feet within 75 days. Under rainfed conditions at Coimbatore it has yielded 30-60 thousand pounds per acre in 3-4 cuttings per year.

4. *Melinis minutiflora*.

Eng.: Elwatkala grass.

A native of South America and recently introduced into this State. The plant is covered all over with full of glandular hairs and by virtue of these, it is supposed to repel reptiles and mosquitoes. Though a perennial, it does not survive extreme drought.

5. *Panicum antidotale*, Retz.

A native of Australia and India. The type received from Australia is a good drought resistant grass whereas the indigenous one is a more mesophytic type. Under rainfed conditions at Coimbatore it has yielded 11,000 pounds per acre in 2 cuttings per year. The plants when young are readily grazed, but when allowed to stand long, the culms become woody.

6. *Panicum maximum*, Jacq.

Eng.: Guinea grass.

A native of Tropical Africa and widely cultivated. The best fodder grass under irrigated conditions and is generally raised as such. Yields 50 to 75,000 lb. per acre per year in 6-8 cuttings. Under

sewage farm conditions it has yielded up to 200,000 lb. per acre per year at Madurai. Under rainfed conditions at Coimbatore, it has yielded about 21,000 lb. per acre per year in two cuttings.

7. *Pennisetum purpureum*, Schum.

Eng.: The napier grass.

A Native of Tropical Africa. It is cultivated in many places especially in military farms and at Sosur Cattle Farm. This species is coarser than the former and grows better. The yields may be up to 80 tons per acre per year in 5-6 cuttings. The dry strain of this species is shorter and thrives well in areas with moderate rainfall under rainfed conditions.

8. *Pennisetum clandestinum*, Hochst.

Eng.: The kikiyu grass.

A native of tropical Africa. A perennial runner and introduced in the hill stations of Nilgiris, Kodaikanal and Anamalais and has got well established in these areas. Cattle relish it very much and the grass is becoming an important fodder grass on the hills.

9. *Sorghum sudanense*, Stapf.

Eng.: Sudan grass.

A native of Africa. It comes up well in semi-arid regions. It is an annual or perennial grass growing up to 4-5 feet and yielding about 2½ tons of hay an year.

10. *Tricholana rosea*, Nus.

Eng.: Natal grass.

A native of Africa. A perennial grass and comes up in semi-dry regions. Is being grown on the military grass farms to a small extent.

FODDER CROPS CULTIVATED IN THE MADRAS STATE.

Non-Leguminous fodder crops.

1. *Sorghum*, *Andropogon sorghum*, Brat.

Tel.: Jonna; Tam.: Cholam.

An important grain crop and also cultivated purely as fodder in many places. There are distinct fodder types in this species like Irungu Cholam, Kaki Jonna and Patcha Jonna. Duration ranges from 110 to 120 days and yields about 15 to 20,000 lb. of green fodder per acre under irrigated conditions.

2. *Cumbu—Pennisetum typhoides*, Hubb.

Tel.: Sajja; Tam.: Cumbu.

This also an important millet in the State. This is grown mainly as a grain crop but in a few places it is also raised as fodder. Duration ranges from 80 to 100 days and yields from 10,000 to 15,000 lb. of green fodder per acre under irrigation.

3. *Maize: Zea Mays*, L.

Tel.: Mokka Jonna; Tam.: Mokka Cholam.

Cultivated to a small extent in many places in the State for the cobs and to a lesser extent as a fodder crop. Duration from 80 to 100 days and yields, from 15 to 20,000 lb. of green fodder per acre under irrigation.

4. Teosinte: *Euchlaena mexicana*:

Similar to maize but is raised only as a fodder crop. At present it is not cultivated anywhere outside the Government farms in the State. Duration from 80-100 days and yields from 15 to 20,000 lb. of green fodder per acre under irrigated conditions.

5. Kollagangeru: *Ipomoea hispida*, R. and S.

Tel.: Kollagangeru.

A bushy twining plant and is grown in Guntur district as a mixture along with Sorghum for fodder purpose. It is not grown outside this area and the Government farms. Not grown as a pure fodder. Yields up to 5,000 lb. of green fodder in the mixed crop.

Guinea grass, Napier grass, Rhodes grass and Sudan grass which are also cultivated have already been mentioned under fodder grasses.

Leguminous fodder crops.

1. Pillipesara: *Phaseolus trilobus*, Ait.

Tel.: Pillipesara.

An important and popular fodder crop. It is grown extensively in the Godavari and Krishna deltas and its cultivation is gradually spreading to other areas also. It is raised as a pure crop in wet lands after the harvest of paddy. Its duration is from 120 to 140 days during which period 2-3 cuttings can be taken with an yield of 20 to 25,000 lb. of green fodder per acre. It also occurs in dry lands. It is also a popular green manure crop.

2. Theegapesara: *Phaseolus sublobatus*, Roxb.

Tel.: Theegapesara.

Less common and cultivated in parts of Krishna and Guntur districts as a fodder crop like the above.

3. Naripayir: *Phaseolus aconitifolius*, Jacq.

Tam.: Naripayir, Tulukkan payir.

Grown as mixed in dry lands along with cholam and cumbu in the southern districts. A good nutritious fodder and very much relished by the cattle. Yields up to 6,000 lb. of green fodder as a mixed crop.

4. Sunnhemp: *Crotalaria juncea*, L.

Tel.: Janumu; Tam.: Janapai.

A popular fodder crop extensively grown for fodder in the Krishna and Godavari deltas. It is raised in wet lands after paddy just as Pillipesara. Duration from 60-90 days and yields up to 15,000 lb. of green fodder per acre. It is also used as a green manure crop and in some places for fibre.

5. Cowpea: *Vigna catjang*, Walp.

Tel.: Alasanda; Tam.: Karamani.

A quick growing leguminous annual and cultivated mostly as a pulse. As a green fodder also it is very much valued. It yields from 10 to 15,000 lb. in 90 to 110 days.

APPENDIX III.

SOME COMMON FODDER-YIELDING TREES IN THE MADRAS STATE.

1. *Acacia arabica*, Wild.

Tam.: Karuvelam; Tel.: Nalla thumma.

A moderately-sized tree, with golden-yellow flowers, long white thorns and dark-brown rough bark; wood reddish brown, hard and strong, useful for making agricultural implements. The pods which are long (8—10 inches) beaded and with white tomentose hairs are readily eaten by cattle, sheep and goats. When ripe the pods fall to the ground and are greedily picked up by the animals. The leaves and tender shoots are eaten by sheep and goats.

2. *Acacia Catechu*, Wild.

Tam.: Karungali; Tel.: Sundra.

A moderately-sized deciduous tree with pale yellow flowers; bark dark greyish brown; wood red and hard and from it the tan 'Cutch' is extracted. The leaves are eaten by sheep and goats.

3. *Acacia ferruginea*, DC.

Tel.: Ansandra; Tam.: Velvelam.

A large deciduous pretty tree, wood very hard, used for building and agricultural purposes. Leaves are readily eaten by cattle, sheep and goats.

4. *Acacia leucophloea*, Wild.

Tam.: Velvalam; Tel.: Tella thumma.

A moderately-sized tree with pale yellowish white flowers and less thorny than *A. arabica*. Bark whitish-grey when young and brown when old; wood hard and tough. Pods are small 2—2½ inches long, flattish, curved and are readily eaten by cattle, sheep and goats. The leaves and tender shoots are eaten by sheep and goats.

5. *Adina cordifolia*, Hook.

Tam. and Mal.: Manja kadambe; Tel.: Bandaru; Kan.: Ahnau.

A large, beautiful deciduous tree with large acuminate leaves and yellow flowers in small heads. Bark thick, grey, rough; wood yellow, moderately hard and used for agricultural implements, combs, etc. Young trees are often cut for house posts. The leaves are eaten by cattle, sheep and goats.

6. *Aegle Marmelos*, Corr.

Tam.: Vilva; Tel.: Maedu; Mal.: Kovalam.

A small deciduous thorny tree. The fruit is valued for its medicinal use. The young shoots and leaves are eaten by cattle, sheep and goats.

7. *Ailanthus excelsa*, Roxb.

Tam.: Perumaran, Pasmaman; Tel.: Peddamanu, Pedda vepa chettu.

A large beautiful tree with rough grey bark and soft white wood, growing up to 40 to 50 feet high; gives plenty of foliage which is readily eaten by cattle, sheep and goats.

8. *Albizzia amara*, Boiv.

Tam.: Wunja, Thurinji; Tel.: Chiguru chettu, Nalla ranga; Mal.: Varachi.

A moderately-sized deciduous tree with pinkish white flowers. The wood is purplish-brown, very hard and used for making agricultural implements. The leaves form a good fodder and are readily eaten by cattle, sheep and goats. A few semi-wild breed of cattle occurring in parts of Salem and North Arcot districts are said to depend mainly on the young leafy shoots of this tree. The leaves are dried, finally powdered and used for bathing purposes either alone or mixed with soap-nut powder.

9. *Albizzia Lebbeck*, Benth.

Tam.: Vagai; Tel.: Dirisana; Mal.: Vaja.

A large deciduous tree, with large white flowers and characteristic long and flat pods remaining on the tree when ripe. Wood dark brown, hard and useful for making agricultural implements. The tree yields plenty of foliage which is readily eaten by cattle, sheep and goats.

10. *Albizzia marginata*, Marr.

Tam.: Pili yagei; Tel.: Konda chiragu; Mal.: Potta vaga.

A large deciduous tree with white flowers and pink filaments. Bark grey; wood brown and soft. The leaves are readily eaten by cattle, sheep and goats.

11. *Albizzia odoratissima*, Benth.

Tam.: Karu vagei; Tel.: Chinduga; Mal.: Puli vaga.

A large tree with sweet scented white flowers. Bark dark grey wood dark brown and hard and useful for making agricultural implements especially for wheels and oil mills. Leaves are produced in plenty which are readily eaten by cattle, sheep and goats.

12. *Albizzia procera*, Benth.

Tam.: Konda vaghai; Tel.: Tella chinduga; Mal.: Karumthagara.

A very large deciduous tree, conspicuous for its yellowish white bark and head of spreading branches. Flowers greenish white and small. Wood brown and hard and useful for making agricultural implements. The tree gives a fair amount of foliage which is readily eaten by cattle, sheep and goats.

13. *Antidesma diandrum*, Roth.

Tel.: Pellagumudu.

A small deciduous tree with thin leaves, pleasantly acid and purplish red edible fruits. Leaves are eaten by cattle, sheep and goats.

14. *Anogeissus latifolia*, Wall.

Tam.: Vally Naga; Tel.: Chiriman; Mal.: Mara kanchiram.

A large deciduous tree, conspicuous by its smooth grey bark and by the leaves turning red before falling. Wood grey and hard and useful for agricultural implements; also a very valuable fuel. The leaves are readily eaten by cattle, sheep and goats and also used in tanning.

15. *Artocarpus integrifolia*, Linn.

Tam.: Pila; Tel.: Panasa; Mal.: Pillava; Kan.: Halasu.

A largely evergreen tree. Bark black mottled green and smooth heart wood bright yellow and used for carpentry. The tree produces plenty of foliage which is readily eaten by cattle, sheep and goats.

16. *Azadirachta indica*, A. Juss.

Tam.: Vapa; Tel.: Vapa, Yapa; Mal.: Vappa; Kan.: Bevina-mara.

A very important and useful deciduous tree with hard close-grained wood giving a valuable timber. The bark, leaves, flowers and seeds are medicinal. The leaves are eaten by sheep and goats and by cattle in some localities.

17. *Balanites Roxburghii*, Planch.

Tam.: Nanjunda; teli gari.

A small thorny tree with ashy grey foliage, grey bark and yellowish white wood. The leaves are eaten by cattle, sheep and goats.

18. *Bambusa*, spp.

Tam.: Mungil; Tel.: Veduru; Mal.: Mulla, Molai; Kan.: Dongi.

There are two species of *Bambusa* occurring in Madras of which *B. arundinacea* Willd. occurs in all the districts from 100 to 4,000 feet. Used for building, scaffolding and for many domestic purposes. The split culms are woven into mats, baskets, fans, etc. The grain when available is eaten by the poor. The leaves like any other grass, form a good fodder for the cattle.

19. *Bauhinia malabarica*, Roxb.

Tam.: Malayuthi; Tel.: Puli chinta, Puli chinta, Are; Kan.: Cheppura.

A moderately-sized deciduous tree with cream-coloured flowers. The leaves are acidic and are eaten by sheep and goats and to a less extent by cattle.

20. *Bauhinia purpurea*, Linn.

Tam.: Mandari; Tel.: Kanchanam, Bodanta chettu.

A moderate-sized evergreen tree often bushy with large leaves. Bark grey to brown; wood dark brown, moderately hard, used for implements. The leaves are eaten by cattle, sheep and goats. The leaves and young flower buds are used as vegetables.

21. *Bauhinia variegata*, Linn.

Tam.: Segapu-machari; Tel.: Mandari, Bodantham.

A moderate-sized deciduous tree, Bark grey; wood greyish-brown, moderately hard. The leaves are eaten by cattle, sheep and goats. The young leaves and flower buds are a leafy vegetable.

22. *Bassia latifolia*, Roxb.

Tam.: Illupe; Tel.: Ippa; Kan.: Ippi; Mal.: Ilupa.

A large handsome deciduous tree. The large fleshy cream-coloured corollas contain much sugar and are an important article of food and for the distillation of spirit. They fall readily from the trees

when ripe and can be collected under them. The large ovoid greenish fruits have large fleshy cotyledons which give a valuable oil for burning. The leaves, flowers and fruits are eaten by cattle, sheep and goats.

23. *Bombax malabaricum*, DC.

Tam.: Ilavu; Tel.: Buruga; Mal.: Ilava; Kan.: Burla.

A very conspicuous tree of gigantic size flowering when bare of leaves in the hot season. The carpellary cotton surrounding the seeds is used for stuffing pillows. The leaves are readily eaten by cattle, sheep and goats and the seeds can also be fed to cattle.

24. *Buchanania angustifolia*, Roxb.

Tam.: Mudamah, Sara parupu; Tel.: Pedda sara, Sara pappu.

A medium-sized tree with rough, deeply-fissured bark. The leaves are readily eaten by cattle and the kernels of the seeds which have a pleasant flavour form a nourishing human food.

25. *Buchanania Lanzan*, Spr.

Tam.: Morala; Tel.: Morli, Sara; Kan.: Nurkul; Mal.: Munga pera.

A moderately-sized deciduous tree with rough bark and greyish brown wood. The leaves are eaten by cattle, sheep and goats and the kernels of the seeds are a nutritious human food.

26. *Butea frondosa*, Koem.

Tam.: Porasu; Tel.: Moduga; Mal.: Palasin samatha; Kan.: Muttaga.

A deciduous tree, very conspicuous when in flower before the leaves appear, the large flowers being orange-scarlet set in dark velvety calyces. The leaflets are large and commonly used to serve as plates for taking food. The tree produces plenty of foliage which is readily eaten by cattle, sheep and goats.

27. *Cassia fistula*, Linn.

Tam.: Kennei; Tel.: Rela; Mal.: Kenna; Kan.: Kakka.

A moderately-sized tree with pale smooth bark when young darker and rough when old, recognized by its long racemes of bright yellow flowers and long cylindrical pods. Wood is hard and durable and useful for making agricultural implements. The leaves are readily eaten by cattle, sheep and goats.

28. *Cedrela Toona*, Roxb.

Tam.: Santhana vembu, Thevadaram; Mal.: Methangirivembu; Kan.: Tundu.

A large and beautiful tree with pinnate leaves, lanceolate long acuminate leaflets. Bark reddish and wood red moderately hard, useful for building and furniture. The young shoots, leaves and seeds are eaten by cattle, sheep and goats.

29. *Cordia obliqua*, Willd.

Tam.: Vidi; Tel.: Iriki, Nakkeri; Mal.: Virusham.

A moderate-sized deciduous tree with white flowers and yellow or pink ovoid glossy berries with accrescent calyx containing a mucilaginous transparent edible pulp. Bark grey; wood greyish brown,

moderately hard and useful for agricultural implements. The leaves are eaten by cattle, sheep and goats.

30. *Dalbergia latifolia*, Roxb.

Tam.: Eravadi; Tel.: Jitagi.

A large deciduous tree, bark thick and grey; wood extremely hard, dark purple used chiefly for furniture and agricultural implements. The leaves are eaten by cattle, sheep and goats.

31. *Dalbergia Sissoides*, Crab.

Tam.: Thothagatti; Mal.: Satti, Vitti, Karitti.

A large deciduous tree, giving a fine dark purple wood used in furniture making. The leaves are eaten by cattle, sheep and goats.

32. *Dalbergia Sissoo*, Roxb.

A tree of river beds in the sub-Himalayan tract of North India and valuable for its hard dark brown wood used for furniture; often planted in South India and sometimes found run wild. Leaves are eaten by cattle, sheep and goats.

33. *Delonix elata*, Gamb.

Tel.: Sunkesara; Tam.: Pedanarayana.

A medium-sized tree, planted as an avenue. The leaves are eaten by sheep and goat and also fed to buffaloes.

34. *Dolichandrone falcata*, Seem.

Tam.: Katuvarsana; Tel.: Udda, Wodi, Chittivadi, Chitee niruddi; Kan.: Wudige.

A small deciduous tree with white flowers. Bark bluish grey coming in scales; wood white and hard.

35. *Dolichandrone atrovirens*, Sprag.

Tel.: Nirounddi; Tam.: Pumadri.

A moderate-sized tree with pretty white flowers. Leaves are eaten by cattle, sheep and goats.

36. *Elacodendron glaucum*, Pers.

Tam.: Karuvai, Kannirumaram; Tel.: Nirija, Nardi; Mal.: Karuniraka; Kan.: Kannur mara.

A graceful evergreen tree with a grey bark and light brown close-grained wood useful for cabinet work. The leaves are eaten by cattle, sheep and goats.

37. *Emblica officinalis*, Gaertn.

Tel.: Usiri; Tam.: Nelli.

A small deciduous tree. The fleshy fruits are edible. Leaves are eaten by cattle, sheep and goats.

38. *Enterolobium saman*, Prain.

Tam.: Thungu moonji; Tel.: Nidraganneru.

A quick growing moderately-sized tree, producing plenty of foliage which are eaten by cattle, sheep and goats. It is introduced from South America and is often grown as an avenue tree and thrives well in places of heavy rainfall.

39. *Eriodendron pentandrum*, Kuiz.

Tam.: Illavam panji; Tel.: Buruga; Mal.: Panjamaram, Panya.

A tall tree with smooth green stem and horizontal branches arranged in whorls. The carpellary cotton surrounding the seeds is used for stuffing pillows and is of better quality than that of Bombax. The leaves are readily eaten by cattle, sheep and goats, and the seeds can also be fed to cattle.

The tree is not indigenous but naturalized on the West Coast and often planted there and many other parts of South India.

40. *Erythrina indica*, Lam.

Tam.: Kalyana Murunga; a Mal.: Muruka.

The tree is striking when in flower. Bark yellowish, smooth, and shining; wood very soft and white. The leaves are eaten by cattle, sheep and goats.

41. *Feronia Elephantum*, Corr.

Tam.: Vila, Vilatti; Tel.: Velaga; Mal.: Vila; Kan.: Bilwar.

A small slow-growing deciduous spiny tree with yellowish white, hard wood. The pulp of the fruit is much eaten. The leaves are eaten by sheep and goats.

42. *Ficus bengalensis*, Linn.

Tam.: Al mamaram; Tel.: Marri; Mal.: Ala; Kan.: Alada.

A very large tree throwing out numerous large aerial roots from the main trunk and large branches which descend to the soil and form supports. The tree produces plenty of foliage which is readily eaten by cattle and more specially by sheep and goats. The fruits which fall to the ground when ripe are also edible.

43. *Ficus glomerata*, Roxb.

Tam.: Atthi; Tel.: Atthi; Mal.: Atthi; Kan.: Atti.

A large deciduous tree with few and short aerial roots, bark grey to reddish brown. The leaves are readily eaten by cattle, sheep and goats and the fruits which fall to the ground when ripe are edible. The unripe fruits are used as a vegetable.

44. *Ficus infectoria*, Roxb.

Tam.: Malai-ichchi; Tel.: Pati juvi; Mal.: Cherla; Kan.: Basari.

A large deciduous tree without aerial roots. Bark greenish grey, smooth, wood grey, moderately hard. The leaves are eaten by cattle, sheep and goats.

45. *Ficus religiosa*, Linn.

Tam.: Arasa, Arasu; Tel.: Ragi, Ravi; Mal.: Arasu; Kan.: Arali aswatham.

A large tree with few or no aerial roots; produces a large amount of foliage which is readily eaten by cattle, sheep and goats. In places where the plant occurs in large numbers the cultivators cut down the branches with the leaves and take them home for feeding their cattle.

46. *Ficus retusa*, Linn.

Tam.: Pon-ichchi; Tel.: Konda juvi; Mal.: Ittiyal; Kan.: Pilata.

A large evergreen tree with few aerial roots. Bark brown and fairly smooth. The leaves are readily eaten by cattle, sheep and goats.

47. *Ficus Tsiela*, Roxb.

Tam.: Kal-ichi; Tel.: Padda Juvi; Mal.: Kirgai; Kan.: Billi-basara.

A large spreading tree with few or no aerial roots. Bark greenish grey and smooth. Produces plenty of foliage which is readily eaten by cattle, sheep and goats.

48. *Gardenia gummifera*, Linn.

Tel.: Manchi bikki; Kan.: Chitra bikka.

A small tree with rough twisted branches. Leaves are eaten by cattle, sheep and goats.

49. *Gmelina arborea*, Roxb.

Tam.: Gumadi, Umi; Tel.: Gumar tak; Mal.: Kumbil; Kan.: Shivani.

A fairly large deciduous tree with handsome panicles of brownish yellow flowers and large yellow fleshy drupes. Bark smooth, whitish-grey, wood greyish-white, hard and useful for furniture. The fruits and leaves are eaten by cattle, sheep and goats.

50. *Garunga Pinnata*, Roxb.

Tel.: Garuga; Tam.: Karre Vemba.

A large tree with thick bark. The fruit is edible. The leaves are eaten by cattle, sheep and goats.

51. *Grewia subinaequalis*, DC.

A small shrub of forest grass lands. Leaves are eaten by cattle, sheep and goats.

52. *Grewia tiliaefolia*, Vahl.

Tel.: Charachi; Tam.: Umi.

A medium-sized tree with large leaves. Wood strong and flexible used for shafts of carts, bars and other implements. Leaves are eaten by cattle, sheep and goats.

53. *Guazuma tomentosa*, Kunth.

A small tree with obliquely cordate leaves and yellow flowers in large terminal and axillary panicles. The leaves are eaten by cattle, sheep and goats. The ripe fruits which are black and are of the size of a large marble are edible and relished especially by children.

An introduced tree, often found run wild usually in the vicinity of towns and villages, indigenous in tropical Africa.

54. *Hardwickia binata*, Roxb.

Tam.: Acha; Kattudugu; Tel.: Yepi; Kan.: Kamra.

A large deciduous tree with small yellowish flowers. Bark dark-grey and rough; wood extremely hard, dark-red and useful for making agricultural implements. The leaves are cut for manure and the branchlets for the fibre of bark. The leaves form a good fodder for cattle, sheep and goats.

55. *Hemicyclia sepiaria*, W. & A.

Tel.: Bira; Tam.: Virai.

A small evergreen tree or branching shrub. Leaves are eaten by cattle, sheep and goats.

56. *Ixora parviflora*, Vahl.

Tel.: Kori, Goriyi; Tam.: Shulunndu.

A small evergreen tree or large shrub with white flowers. The green branches are said to be used for torphus. Leaves are eaten by sheep and goats.

57. *Holoptelea integrifolia*, Planch.

Tam.: Aya, Ayil, Tambachi; Tel.: Thapasi, Nauli; Mal.: Aval; Kan.: Thavasi; Hind.: Papri.

A large deciduous tree. Bark whitish grey. The leaves and young parts are eaten by cattle, sheep and goats.

58. *Kydia calycina*, Roxb.

Tel.: Potri; Kan.: Bendi.

A moderate-sized, quick growing tree with white soft wood. The leaves are readily eaten by cattle, sheep and goats.

59. *Lagerstroemia Flos-Reginae*, Retz.

Tam.: Kadadi, Pumaruthu; Mal.: Mani Maruthu; Beng.: Jarul.

A large deciduous tree with handsome large mauve flowers and large seed capsules. Bark smooth, usually grey; wood light red, hard, valuable for building, for shipwork and furniture. The leaves are eaten by cattle, sheep and goats.

60. *Mangifera indica*, Linn.

Tam.: Maa; Tel.: Mamidi; Mal.: Mavu; Kan.: Mavu, Mavina.

A large-spreading evergreen tree reaching 50 feet in height, cultivated for its edible, very important fruit. The leaves are readily eaten by cattle, sheep and goats.

61. *Mitragyna parvifolia*, Karth.

Tel.: Chinna Kadambu; Tam.: Nir Kadambe.

A large deciduous tree with very variable leaves. Wood used for furniture and implements. Leaves are eaten by cattle, sheep and goats.

62. *Morinda tinctoria*, Roxb.

Tam.: Muna, Nona; Tel.: Maddi, Togari; Mal.: Manchapavatta.

A moderate-sized deciduous tree. The leaves are eaten by sheep and goats.

63. *Moringa oleifera*, Lam.

Tam.: Moringa; Tel.: Mūnaga; Mal.: Moringa; Kan.: Nuggemara.

A medium-sized tree with grey bark and soft white wood. The tender fruits are eaten as a vegetable and the seeds give luminent oil. The tender shoots and leaves are very much relished by cattle, sheep and goats and are said to increase the flow of milk in cows.

64. *Odina Wodier*, Roxb.

Tam.: Wodier, Odiyamaram; Tel.: Gumpini, Oddhi; Kan.: Crodda, Geru; Mal.: Annakara, Kalasun; Hind.: Kaimal.

A fair-sized tree with thick bark and reddish brown wood. The leaves are readily eaten by cattle, sheep and goats.

65. *Ougeinia dalbergoides*, Benth.

Tel.: Tella motku, Tella moduga; Hind.: Sandan.

A moderate-sized tree, very pretty in flower. Bark dark-brown, wood light brown and hard and useful for carts and implements. The leaves are eaten by cattle, sheep and goats.

66. *Pithecolobium dulce*, Benth.

Tam.: Koduka puli; Tel.: Sima chintha; Kan.: Sinehunise.

A tree which, when allowed to grow, reaches a good size. Quick-growing and forms a good live fence. Pods are eaten by cattle and the foliage by the goats.

67. *Pongamia glabra*, Vent.

Hind.: Kenji; Tam.: Ponga, Pungam; Tel.: Kanuga; Mal.: Ugumeram; Kan.: Ugge mara.

A moderate-sized nearly evergreen tree. Bark thick, wood white, moderately hard used for cart-wheels and other purposes; gives a large amount of foliage which is eaten by cattle and readily by goats. It is also one of the important green-leaf manure plants. Seeds give an oil used in medicine and for burning.

68. *Premna latifolia*, Roxb.

Tel.: Pedda Nellakura.

A small tree, the leaves usually drying blue or black. Leaves are eaten by cattle, sheep and goats.

69. *Prosopis julifera* (S.W.), D.C.

The Algaroba, Mesquite, or Keawe tree, native of West Indies. The flowers are a source of honey. The leaves, shoots and pods are used to feed cattle and the pods being said to be "as nutritious as corn". The tree is a prolific yielder and is extensively cultivated in America. The tree is quick-growing and highly drought resistant and can be grown in arid barren soils where no other crop could be grown.

70. *Prosopis spicigera*, Linn.

Tam.: Perumbu, Vanni; Tel.: Chani, Jammi.

A moderate-sized deciduous tree with many thorns on broad bases. Bark grey, wood hard and purplish brown. The pods and leaves are eaten by cattle, sheep and goats.

71. *Pterocarpus Marsupium*, Roxb.

Hind.: Bijasal; Tam.: Vengai; Tel.: Yegi; Mal.: Venga; Kan.: Honne.

A large deciduous tree with thick grey bark and very hard yellowish brown wood, used for building, furniture and agricultural implements. It gives a red-gum-resin 'kino' used in medicine. The leaves are eaten by cattle, sheep and goats.

72. *Pterocarpus santalinus*, Linn.

Hind.: Lal chandan; Tam.: Chivappuchandanum; Tel.: Yerra Chendanum.

A very pretty moderate-sized tree. Bark blackish brown, wood extremely hard, dark claret-red to black and used for carvings. Leaves are eaten by cattle, sheep and goats.

73. *Pterospermum suberifolium*, Lan.

A moderate-sized pretty tree with light red wood. Leaves are eaten by cattle, sheep and goats.

74. *Schleichera trijuga*, Willd.

Hind.: Kusam; Tam.: Puvan; Tel.: Puska; Mal.: Puvam; Kan.: Lchakota.

A large deciduous tree with large leaflets, which are bright red when young. The aril of the fruit which is about one inch long is edible and the seeds give an oil used for burning. The bark is grey and wood hard and useful for making agricultural implements. The leaves and pods are eaten by cattle, sheep and goats.

75. *Sesbania aegyptiaca*, Pers.

Tam.: Chittakatti; Tel.: Suiminta.

A quick growing soft-wooded shrub, with small pink flowers. The leaflets are comparatively small and are eaten by cattle, sheep and goats.

76. *Sesbania grandiflora*, Pers.

Tam.: Agathi; Tel.: Avesi.

A quick-growing small soft-wooded tree, slender stemmed, reaching 20—30 feet high, with large showy red or white flowers and long pods. The leaves and flowers and green pods form a good cattle feed and are said to increase the yield of milk. Young leaves are also eaten as a vegetable.

Cultivated in gardens or betel-vine plantations as supports and also in sugarcane fields as windbreaks; not indigenous.

77. *Syzygium Jambolanum*, DC.

Tam.: Naval, Nagai; Tel.: Neredu; Mal.: Naga; Kan.: Narala.

A large evergreen tree with white flowers and purple edible fruit. The fruit in cultivation is oblong and in a wild state usually small and globose. Bark smooth, light grey; wood hard reddish grey and useful for agricultural purposes. The leaves are readily eaten by cattle, sheep and goats.

78. *Stereospermum suaveolens*, DC.

Hind.: Padal; Tam.: Padri; Tel.: Kala goru; Kan.: Billa.

A large tree with dull crimson flowers. Bark grey, wood hard, yellowish, brown and useful for many purposes. The leaves are eaten by cattle, sheep and goats.

79. *Sterblus asper*, Lour.

Tam.: Pura, Pirasu; Tel.: Pakki; Mal.: Parava, Pareukeu; Kan.: Mitli; Puniat

A small evergreen tree with wedge-shaped leaves. Bark soft, light grey and wood white. The rough leaves are used to polish ivory and wood and are also eaten by cattle, sheep and goats.

80. *Terminalia bellerica*, Roxb.

Hind.: Bahera; Tam.: Thani; Tel.: Tani; Mal.: Thani.

A large deciduous tree with long petioled leaves. Bark bluish grey with vertical cracks; wood yellowish grey. The fruit is the Bellarie myrabolan used in tanning. The leaves are eaten by cattle, sheep and goats.

81. *Terminalia paniculata*, Roth.

Tel.: Neemeeri; Tam.: Pekarakai.

A large deciduous tree. Wood very hard and useful for building purpose. Leaves are eaten by cattle, sheep and goats.

82. *Terminalia tomentosa*, W. & A.

Tel.: Tani.

A very large tree with the under surface of the leaves villous. Leaves are eaten by cattle, sheep and goats.

83. *Thespesia populnea*, Cay.

Tam.: Puvarasam; Tel.: Gangaravi; Mal.: Porasu; Kan.: Huvarasi.

A fairly large quick-growing evergreen tree with cordate entire long petioled leaves. The leaves are eaten by sheep and goats.

84. *Trewia nudiflora*, Linn.

Hind.: Gumhar.

A large deciduous tree with large leaves. Bark smooth, grey, wood white, soft, used for drums and carved images. Leaves are eaten by cattle, sheep and goats.

85. *Wrightia tinctoria*, R.Br.

Hind.: Khirmi; Tam.: Nila palai; Tel.: Tella pala, Pala; Mal.: Aiya pala, Nila pala; Kan.: Kadnilli.

A small deciduous tree with white flowers and narrow foliicles. Bark pale, smooth, wood dark grey to black; wood reddish and hard. The leaves are eaten by cattle, sheep and goats.

86. *Ziziphus jujuba*, Lam.

Hind.: Ber; Tam.: Yellande, Ilandai; Tel.: Regu, Reni, Rengha; Mal.: Cherumali, Ilanda; Kan.: Yelchi, Bore.

A low much-branched thorny tree with erect, often thick, stem and round head. Bark dark grey to black; wood reddish and hard. The fruit is edible. The leaves are eaten by sheep and goats.

87. *Zizyphus Xylopyrus*, Willd.

Tel.: Got; Tam.: Kottai.

A large straggling shrub of globose velvety fruit. The leaves are eaten by sheep and goats.

APPENDIX IV.

STORAGE OF FOREST FODDER AGAINST SEASONS OF SCARCITY.

Forest grazing is notoriously seasonal corresponding mostly to monsoon months, say from July to January. After February only dried over-mature grasses of low digestibility and still lower protein content are available in the reserves. This should not be confused with hay, which is cured from grass, cut slightly earlier and is richer in proteins and starch equivalents than this aftermath. This aftermath will be useful only as a roughage and is scarcely rich enough to maintain the conditions of the cattle. The grazing grounds thus become mere exercising grounds and even this dried fodder will disappear later on in summer, when forest fires do occur. No serious attempt has been hitherto made to overcome or reduce the rigour of this scarcity of cattle fodder in summer months. This is an annual problem.

In the Ceded districts of the State which do not lie definitely in either of the monsoon zones, the rains fail in some years and acute scarcity and distress occur then. Even the little amount of cattle fodder, which the ryots expect from their fields for their useful cattle, will no longer be available and the reserved forests have to bear an additional burden. These are the problems and the first step towards their solution lies only in the timely conservation of cattle fodder, available in the reserved forests of our State.

An examination of the forests will reveal that the cattle are not able to utilize all the pasture available in the reserves during the monsoon months when grasses grow. Great quantities of fodder will then be available, which if conserved at the proper time and stored, can be utilized during periods of fodder scarcity, like the summer months and famine periods.

Before considering the different methods of conservation at present known, it will be useful to know the changes in the food value which occur as the plants grow up. Generally speaking all crops are richer in proteins and in all nutrients when in their young stages of growth. This is particularly so with grassland herbage, which is a highly concentrated foodstuff in its early days of active growth, as the protein is high and fibre low. Again the mineral contents and vitamin potency of plants become poorer as the plants become older. These facts have to be borne in mind, when appreciating the different methods of conservation of forage at present adapted.

Forest fodder which is primarily grassland forage, can be conserved either by drying it naturally or artificially, or by ensiling it. If it is dried naturally it is called hay; if artificially it is called dried grass. At the outset it must be stated that all these methods of conservation are complementary and have definite places in the economics of cattle feeding.

The chief operation in making hay is the evaporation of the water. The rate of drying is slow, since it depends on the relative humidity of the air and, normally, considerable changes occur during the evaporation stage. The cells are alive and respire throughout the drying period. During respiration, the most digestible fractions are utilized first, and the carotene is oxidised fairly quickly and almost completely, reducing the vitamin A potency to an extremely low

level. The nutritive value must and does suffer as a result of the natural drying process. Further, the mechanical losses affect the most valuable leafy parts of the crop, whilst leaching by rain removes the most digestible soluble parts. In addition, the respiration and fermentation processes take toll of the digestible portions of nitrogen free extract. Loss of feeding value is thus high in hay making, since the most digestible parts of the plant are lost.

In artificial drying, the changes are negligible since desiccation and death of the cell are relatively rapid. Consequently, there is very little respiration and the losses of digestible portions and carotene content of the grasses are negligible. Further mechanical losses, fermentation losses and loss by leaching by rain do not occur in dried grass. But subsequent storage of this product is a matter of importance. Poor storage will involve loss of colour and vitamin A potency. The oxidation of carotene must be avoided and boiling is one of the simple ways of minimising this.

The next method of conserving the forage is by ensiling it. Silage is the name given to the succulent material produced by a process of controlled vital changes from a green crop or other material of high moisture content. The storage of materials in a silo, either as grain or as a green crop has been common practice for many hundreds of years. The simplest case is that in which the crop is cut and transported to the container and carefully packed therein, steps being taken to exclude air as completely as possible. The temperature of the mass usually varies varying with the efficiency of exclusion of air. After a suitable time has elapsed, usually about three months, the material is fed to the animals, and if it has been made well it should be palatable and harmless to the cattle. The most obvious changes as compared with the original crop are change in the colour of the material, variable in depth from a light-brown to almost black and the development of a distinctive odour, which may at first repel the cattle and when once they take to silage they do not leave it. A good silage requires: (i) restriction of the amount of air in the mass; and (ii) rapid increase in the acidity of the mass to such a level, that undesirable fermentations are suitably controlled.

The aim should be to keep the temperature down to a reasonable level so that the digestibility of the silage might not be affected and the carotene content might not go down.

Rapid acidification of the mass is an essential feature of good silage. In ordinary silage, the acidification is brought about by the action of lactic acid and it is essential that the formation of lactic acid is stimulated. Since the lactic acid is formed from sugar or other fermentable carbohydrates, the crop should contain an adequate supply, if the acidity is to reach the required level. This accounts for the cutting of the crop for silage at a comparatively advanced stage of growth and also shows why crops like sorghum, rich in sugar, are such satisfactory crops to ensile.

Low temperature fermentation processes in which the mass reaches about 100° F have proved very satisfactory for grassland herbage. It is the most practicable and does not call for any special equipment. The details regarding the formation of silos and making silages can be obtained from the nearest Forest or Agricultural Officer. The following points, however, will be useful. Silage should be

made in layers from freshly cut material, the course of fermentation being controlled by the rate of filling. It is particularly important not to build too fast for the lowest layers, but the rate can be accelerated with height. All silage should be weighed and where practicable sealed off as soon after filling is completed as is possible. Over maturity of material should be avoided.

Stimulation of lactic acid fermentation presents a ready means of controlling changes in the silo, the dominant factor being a rapid acidification by the lactic acid organisms. Sugar is the most efficient substance to be added and it is best given as a solution of molasses. This should be added at the rate of 1 to 2 or even 3 lb. per 100 lb. of green crop, increasing with the protein content of the crop. Thin layers must be filled in, with the usual precautions and each layer is sprinkled with a solution of molasses (1 of molasses to 1 to 2 of water).

Successful silage should not lose more than one quarter of the nutrients in the fresh crop and loss of digestible crude protein should be much less than this.

Of the three methods of conserving fodder, described above, from the point of view of losses of nutrients, artificial drying is the most efficient process and hay-making, whether with special appliances or not, is the worst. Ensilage holds an intermediate position, the adaptations of the process being particularly useful methods to employ. Hay is, as usually produced, a roughage, and is mainly used to make up bulk in the ration, particularly of the most productive stock. But hay made out of younger grasses or crops has a relatively higher protein content and starch equivalent. The field-curing of such younger grasses and crop has to be done with special care. One cannot always depend on manufacturing such superhay in our State since rains may interfere with the drying. But such hay can be and has been produced, during breaks in rain in the Forest Grazing Station in the Coimbatore North Forest Division. Artificially dried crop and silage may be produced with a very high nutrient content capable of replacing concentrated foodstuffs in the ration of highly productive stock. But artificially dried crop requires costly apparatus to manufacture and good sheds for storing them. It may well be left out of consideration in our State as it will be beyond the means of most. Silage does not involve any heavy expenditure on apparatus. Mostly pit silages are made in our State, though this method will be unsuitable in districts, where the sub-soil water level is high, for example in delta districts. In such districts a simple portable wooden silo is indicated but as far as it is known it is a new thing for India. A suitable type of wooden silo has been devised by the Imperial Chemical Industries and dimensioned sketch of it, with working details can be got from the firm. But silage being a succulent fodder cannot be transported over long distances without deterioration and expense, whereas hay, which has a low moisture content can be baled and transported over comparatively long distances at low costs.

The most important point to impress on the agriculturist is the necessity for becoming conservation minded. Experiments in which direct comparisons between hay, the artificially dried grass and silage have been made, reveal that all the three will produce effects which can be predicted from their composition and digestibility. In hay,

the ryot has a roughage which will be useful as the maintenance ration for less productive cattle and also a supplementary feed to make up bulk for the most productive cattle fed on concentrates. It must be mentioned here that cattle cannot live on concentrated foods alone even as human beings cannot live on tabloid foods, for bulk is essential if the physiological functions of the digestive systems are not to be ruined. In silage, the ryot has a more productive food than hay, since it can replace concentrates. It is clear that the potentialities of the grasses found in our reserved forests are not now exploited to the full. If the ryot wants succulent and concentrated fodder he can ensile the surplus grass at any time and store it in the silo itself until it can be used to greater advantage, thus preventing the considerable waste which takes place every year on most of our grassland. If he wants bulk fodder he can make hay though he cannot do it at all seasons of the year. Its manufacture is restricted to a small part of the growing season when the crop is approaching or past maturity and when rains will not interfere. There is considerable surplus of grass in our reserves, during the rainy months and why should this be wasted and left probably to be burnt when it can be ensiled as nutrient fodder or made into hay for use later on in summer months, when such fodder will not be available in the reserves? Ensiling the crop at a relatively early stage of growth would greatly increase the protein content and general feeding value of the product and still allow of subsequent growth which could in turn may be made into good hay. The value of silage is particularly great in our State, where climatic conditions result in a rapid maturing of crop, with a consequent marked increase, in fibre and decrease in general feeding value. Further, the silo is both the fermentation chamber and the store for the products. The ryot need not construct costly sheds for storing them, a valuable consideration for the ordinary ryot.

According to experiments conducted at the Agricultural Research Station at Pattambi, 100 lb. of good silage can be made at a cost of As. 2-8 to As. 3 and on an average, 1,000 lb. of silage per mensem might be necessary per head of cattle.

Silage is known to preserve well. Recently when a silage pit was opened after 18 months, the silage was still good and palatable. This fact can be easily utilized for the benefit of cattle in times of famine which often occur in our Ceded districts. Silage has a great value in such times of drought as succulent fodder; the difficulty at such times is not only one of the nutrients; the lack of water is often more serious. A battery of silos can easily be formed in districts susceptible to famine, as a fodder reserve, quite apart from the summer reserve. The silage thus preserved will supplement the forest hay, supplied at present by the Forest department to the valuable agricultural cattle in times of drought. If famine does not occur, the silage can be given to the cattle as supplementary rations during the rainy seasons and if it has been made out of young succulent blades, can very easily be substituted for concentrates like poonac, etc. The possibilities are thus immense and this method of reducing the distress of cattle in times of famine is strongly recommended.

The full potentialities of silage have not been realized by our ryots. In the first place, it is more even in composition than artificially dried crops, in view of the greater speed with which the

crop is cleared. The addition of inorganic nitrogen to silage is a distinct possibility. It is a simple method to add ammonium sulphate, ammonium bicarbonate or urea, in solution with molasses. This has been done without any loss of quality in the resultant product. About 5 lb. of urea or 10 lb. of ammonium sulphate per ton of grass would bring about an increase of 2 lb. of assimilable nitrogen, per ton of silage.

Another useful possibility with silage is the correction of mineral deficiencies in the herbage and this can be done with ease. To correct phosphate deficiency, ammonium phosphate may be added during silage making. This has been done with success, the final product being a perfectly normal sample of satisfactory silage with increased nitrogen and phosphorous content. Calcium can be similarly added as calcium chloride. In districts where deficiencies of a minor element occur, silage is again a valuable vehicle for that addition; the element in question has only to be added in soluble form to molasses solution at a pre-determined rate and will be sprayed on at an even rate throughout the silo. If a metallic oxide is to be added, it would be transformed in the silage as the acetate or lactate, which will be readily assimilable.

In addition, of course, silage possesses as high a vitamin value as any other product of conservation. The time has surely come for a wide expansion in the use of silage. It is the first approach to conservation and putting the economics of the farm on a sound footing. In an essentially agricultural country like ours it is certain that in the intensified conservation of surplus grassland herbage of our forests the solution lies to many of our major agricultural and national problems.

MISCELLANEOUS.



DEVELOPMENT DEPARTMENT

G.O. No. 4470, 21st October 1952

Fodder—Shortage—Report of Special Officers on fodder, milk supply and land utilization problems of Madras State—Recommendations—Orders passed.

Read—the following papers:—

G.O. Ms. No. 112, Development, dated 8th January 1948.

From the Chief Conservator of Forests, dated 17th May 1949,
No. 11529/46-CI.

From the Chief Conservator of Forests, dated 9th April 1950,
No. 11529/46-CI.

From the Board of Revenue, dated 29th May 1950,
L. Dis. No. 80399-V/50-CS.

From the Director of Agriculture, dated 26th March 1951,
L. 4-429/51.

From the Director of Animal Husbandry, dated 29th July 1951,
No. 2234-VI/51.

From the Chief Engineer (Irrigation), dated 1st October 1951,
No. 1009/51-A-15.

From the Board of Revenue, B.P. Mis. No. 1002, dated 28th December 1951.

From the Director of Animal Husbandry, dated 2nd January 1952,
No. 2234-IV/51.

Order—No. 4470, Development, dated 21st October 1952.

The Government have been spending large sums of money to tide over the periodical fodder scarcity in the State. With a view to co-ordinating the work of the State Fodder and Grazing Committee and the proposed Land Utilization Board and examining questions relating to the productivity of land, elimination of fodder scarcity and all aspects of milk production, distribution, etc., it was suggested that a permanent expert committee called the Milk Board might be set up. The Government, however, considered that before constituting such a Board, two officers from the Forest and Agricultural Departments might be appointed to examine all the materials

regarding fodder production and make constructive suggestions for the consideration of the Government. The Government accordingly sanctioned the employment of two Special Officers, one from the Agricultural Department and the other from the Forest Department to investigate the fodder problem and submit a report.

Sri V. S. Krishnaswamy, I.F.S. of the Forest Department and Sri T. Venkataramana Reddi of the Madras Agricultural Service carried out investigations during 1948-49 and submitted a detailed report with recommendations to overcome the fodder shortage in the State. The Government have carefully considered the Report in consultation with the heads of departments concerned and pass the following orders on the suggestions and recommendations in the Report:—

1. *Grazing in reserved forests*—(i) *Increase of grazing fees*.—The question of increasing rates of fees for grazing in reserved forests was examined in detail by the Government from time to time and it was decided that there was no need to raise the rates—*vide* G.O. Ms. No. 4019, Development, dated 30th July 1949. The Government consider that there is no case for reconsidering the decision.

(ii) *Encouragement of rotational grazing*.—The Chief Conservator of Forests has stated in his Letter No. 11529/46-CI., dated 9th April 1950 that during the last eight years it has been possible to constitute 129 rotational grazing blocks in nine forest divisions covering an area of 130,773 acres and that the number of cattle that availed of this system of grazing was 23,476 cow units. He has added that this policy of encouraging rotational grazing will be continued. The Government therefore consider that no separate action is called for on the suggestion of the Special Officers.

(iii) and (iv) *Scientific management and treatment of suitable grass lands and appointment of Agrostologist*.—The Government have under their consideration the question of opening a Research Station at Coimbatore with two sub-stations at Bapatla and Hosur to conduct experiments in grass growing and the employment of one Agrostologist with two Assistants for this work. The Government consider that no further action is called for on the suggestion.

(v) *Development of penning system*.—The Chief Conservator of Forests has reported that the measures suggested by the Special Officers for the development of the penning system are very expensive. The Government agree with the Chief Conservator and consider that no action need be taken on this suggestion.

(vi) *Opening of a grass farm at Gazulapalle in Kurnool district by the Forest Department*.—The Chief Conservator of Forests considers that there is no need to run a grass farm at Gazulapalle as forest hay is generally unpopular and its collection, storage and distribution have to be heavily subsidized by Government. The Government agree with the Chief Conservator and consider that no action is necessary on this recommendation.

(vii) *Revision of estimates of yield of grass*.—The Special Officers have recommended the revision of estimates of the yield of grass from the reserved

forests of Bellary and Anantapur districts including the panchayat forests transferred to the control of the Forest Department. The Chief Conservator of Forests has reported that grazing in panchayat forests is poor and that in times of famine, such forests should be made available for free grazing but should not be exploited for grass. The Government agree with the Chief Conservator and see no need for preparation of revised estimates of yield of grass.

(viii) *Utilization of the pens in the Nallamalais*.—The Special Officers have suggested that during famine periods Government should buy the cattle from scarcity areas and have them transhipped to railheads in Nallamalais and take them to different pens and that these cattle can be re-sold to the ryots of the famine zone as soon as the famine is over. The Government agree with the Chief Conservator of Forests that this suggestion is impracticable.

(ix) *Popularization of the manufacture of silage*.—The Government have sanctioned a small scheme to popularize silage in the Malabar district by demonstrating its preparation at the Agricultural Research Stations, Wynaad and Taliparamba and by offering a subsidy to the ryots who prepare silage. The Government have also ordered as an experimental measure that silage making in pits in one or two places inside reserved forests should be undertaken by the Forest Department.

2. *Prohibition of export of groundnut as kernel*.—The Government have decided in consultation with the Government of India not to impose a ban on the movement of groundnut kernel from Madras State to other States in the Indian Union.

3 and 4. *Government lands outside reserved forests and current fallows*.—Separate orders will issue from the Government in the Revenue Department on the suggestions of the Special Officers relating to this item.

5. *Mixed farming*.—The suggestions of the Special Officers are being examined by Government in the Food and Agriculture Department and separate orders will issue in this regard.

6. *Reserve stock of fodder to be built up and kept as silage in Rayalaseema*.—The Special Officers have suggested that in the Rayalaseema, one year's reserve stock of fodder will have to be built up gradually by growing more fodder crops than necessary in the initial stages, and that this reserve fodder can be kept as silage. The Director of Agriculture has reported that the moisture conditions of the soil in Rayalaseema are not such as to support a thick-grown fodder crop under rainfed conditions, that the cultivation of fodder crops will affect the grain and cash crops and that the storage of fodder as silage is not practicable over a long period. The Government consider that there is scope for growing fodder *chulam* and fodder-yielding trees in the Rayalaseema districts. The Director of Agriculture is requested to take necessary action in the matter.

7. *Special ration for cattle in rice tracts*.—For improving the condition of cattle in rice tracts, the Special Officers have recommended the ration

suggested by Sri Satesh Chandra Das Gupta in his book "The Cow in India". This suggestion is being examined and orders will issue separately in the Food and Agriculture Department.

8. *Popularization of the practice of giving bonemeal and larger doses of salt to cattle in paddy tracts.*—The Government accept the recommendation. The Director of Animal Husbandry is requested to take necessary action in the matter.

9. *Improvement of the quality of cholam and cumbu straws by suitable breeding.*—The Government consider that no separate action is called for on this suggestion, as this is already being attended to by the Agriculture Department.

10. *Growing of berseem.*—The Special Officers have recommended the growing of berseem wherever facilities for irrigation exist. The Director of Agriculture has reported that as berseem was tried and found to be not coming up well, the growing of lucerne is being encouraged by the Agriculture Department. The Government therefore consider that no action is necessary on this recommendation.

11. *Introduction of deep-rooted redgram.*—The Special Officers have suggested that the deep-rooted redgram may be introduced in the drier districts of the State. The Director of Agriculture has reported that improved strains with desirable qualities like increased yield, drought resistance, etc., are being evolved and distributed. The Government direct that the evolution and distribution should be continued so as to reach all the dry districts in the State.

12. *Increase of area under Lucerne, Pillipesara and Sunn-hemp near urban centres.*—The Special Officers have recommended that steps should be taken to increase the areas under lucerne, pillipesara, and sunn-hemp near urban centres and that more propaganda is necessary to achieve this end. The Government accept this recommendation. The Director of Agriculture is requested to take necessary action in the matter and also to render such facilities to the ryots as may be possible to implement the recommendation.

13. *Survey of nutritional deficiencies of cattle feed in different tracts of the state.*—The Government consider that pending the opening of an animal nutrition centre for conducting nutrition experiments, no action is necessary on this recommendation.

14. *Growing of Kolukattai grass.*—It has been suggested by the Special Officers that when re-seeding pastures, kolukattai grass may be given extensive trials. The Agriculture Department is not practising grass farming except in a few places. The Department is advocating raising of grasses suitable for each tract of which kolukattai grass is one. In the circumstances, the Government do not consider that any further action is necessary on this suggestion.

15. *Planting of guinea grass slips alongside watercourses, irrigation channels and field bunds.*—Separate orders will issue in this regard in the Public Works Department.

16. *Introduction of dry Napier grass.*—The Director of Agriculture has reported that thin Napier grass is being introduced wherever facilities exist. The Director is requested to submit an annual report in regard to the areas available for plantation and also the area actually planted with Napier grass. The report should be for each calendar year and should be submitted not later than the 15th February following.

17. *Palatability and digestibility tests with panicum antidotale at various stages of growth.*—The tests have not so far been conducted by the Agriculture Department. They are, however, envisaged in the scheme for research on fodder grasses, legumes and forage crops proposed to be taken up under the auspices of the Indian Council of Agricultural Research.

18. *Raising trees of fuel and fodder value on porambokes, road-sides, etc.*—Necessary instructions have already been issued to all departments under the Tree-planting Campaign.

19. *Determination of the chemical composition of the leaves of the more important fodder trees and working out their digestible nutrients.*—The proposal for opening an Animal Nutrition Section at the Livestock Research Station, Hosur, has been ordered to be deferred in view of the financial stringency. The suggestion of the Special Officers cannot therefore be taken up now.

20. *Introduction of acacia leucophloea and other suitable trees in dry lands.*—The Special Officers have suggested that steps should be taken to introduce a few acacia leucophloea and other suitable trees in the dry lands of the State and that jamun trees may also be grown in suitable places, as its seeds are a fairly rich source of protein and calcium. The Chief Conservator of Forests and the Director of Agriculture are requested to take necessary action in this regard.

21. *Building up of an emergency stock of bago-molasses.*—The Special Officers have suggested that steps should be taken in collaboration with the sugar mills to have an emergency stock of bago-molasses always ready for rushing to scarcity areas in times of need. The Director of Agriculture has reported that a plain mixture of molasses and bagasse is deficient in proteins and is not likely to prove good cattle food. The Director of Animal Husbandry has suggested that molasses and bagasse may be reinforced with groundnut-cake and minerals and that the sugar factories may take this up from the point of view of disposal of molasses. But the sugar factories have at present no difficulty in marketing their molasses and are not likely to be interested in the proposal of the Director of Animal Husbandry. He is therefore requested to take necessary steps to popularize the product suggested by him.

22. *Increase of fodder supply from private lands.*—Separate orders will issue from the Food and Agriculture Department on the recommendation of the Special Officers.

23. *Tungabhadra Project area.*—As the proposed crop rotations in the Tungabhadra Project area will result in heavy fodder deficit, the Special Officers have suggested that the growing of a pure fodder crop over a portion of the Project area may be borne in mind while finalizing the cropping practice. In G.O. Ms. No. 80, Public Works, dated 10th January 1948, the

Government have passed orders on the cropping scheme of the Tungabhadra Project area and it has been indicated in the Order that any water that remained after meeting the requirements of the perennial crops from the months of March to May should be used mostly for growing green manure and fodder crops. The Agriculture Department will also take steps to induce the ryots to raise fodder crops in rotation wherever it is possible.

24. *Tanjore Delta (old).*—Separate orders will issue in the Public Works Department on the recommendation of the Special Officers regarding the growing of green manure crops in the old Tanjore delta area.

25. *Cauvery-Mettur Project area.*—The Special Officers have suggested that the Cauvery-Mettur Project area may be treated as a single-crop paddy area till the soil is completely formed and that the irrigation system may be suitably modified to permit the growing of green manure and fodder crops in the beginning of the growing season. As this suggestion is detrimental to the production of paddy, the Government do not accept the recommendation of the Special Officers.

26. *Malabar.*—The Special Officers have suggested that a legume fodder crop may be grown after paddy in single crop paddy lands of Malabar and that the possibility of growing a green manure-cum-fodder crop in *modan* lands in the years when paddy is not grown should be seriously taken up. They have further suggested that a few demonstration farms should be opened and that systematic attempts should be made to grow mostly fodder shrubs in Government and private lands and that Guinea grass and dry Napier grass may be popularized. The Director of Agriculture has reported that the growing of legume fodder after paddy in Malabar and South Kanara is limited by the moisture conditions of the soil and in many places it is not sufficient even to mature the second crop. Wherever the residual moisture is sufficient, pulse crops like horsegram, green gram, etc., are grown. The Director of Agriculture considers that there is not much scope for growing fodder crops in these areas. The Government agree with him.

The Special Officers have also recommended that silage making may be taken up seriously in Malabar and that giving mineral mixtures to the cattle of Malabar should be popularized, as the Malabar soils are deficient in calcium and phosphorus. The Director of Animal Husbandry has reported that mineral mixtures are being recommended by the Animal Husbandry department and are also being sold in the Veterinary Institutions in Malabar district. As regards silage making, orders have already been issued in G.O. Ms. No. 24, Food and Agriculture, dated 5th January 1952.

27. *Preparation of agricultural working plans.*—The Special Officers have suggested that proper working plans for the agricultural management of the State have to be prepared with a view to raising on a sustained basis the different crops in the lands most suited to them at economic cost and attaining maximum production at minimum cost. Since the system of cropping in any region depends upon a number of economic and climatic factors, the Director of Agriculture is not in favour of the proposal. The Government consider that before drawing up working plans for fodder cultivation, a survey of vacant lands is necessary. Action in this regard is being taken separately.

28. *Study of Agrostology and research on animal nutrition.*—The Special Officers have recommended that a study of Agrostology and research on animal nutrition should be undertaken. There is already a proposal to appoint an Agrostologist in the Agriculture Department. The proposal of the Director of Animal Husbandry for opening an Animal Nutrition and Genetics section at the Livestock Research Station, Hosur, has been deferred. The Government consider that no further action is necessary on this recommendation.

29. *Village cattle.*—The Special Officers have recommended that in order to improve the village cattle, selected bulls should be allowed to mate with selected cows, which should not only be looked after specially but also fed adequately and properly. The Village Livestock Improvement Scheme has already been introduced in four select firkas in the State. The All-India Key Village Scheme of Cattle Improvement which aims at selective breeding of cattle is also being introduced in the State. The Government consider that no separate action is called for on this recommendation.

30. *Use of Guntaka and gorru in the black and red-soil areas of the south.*—The Director of Agriculture has reported that the experience of the introduction of these implements in the Tirunelveli and Ramanathapuram districts has been very disappointing and that the use of these implements depends not only on the nature of the soil, but also on the rainfall and its distribution. The Government therefore consider that no action is necessary on this suggestion.

31. *Conservation of fodder in the form of hay and silage and use of chaff cutters.*—Conservation of hay is now generally done by the ryots by merely stacking hay in haystacks, exposed to the weather and sun. If large quantities are to be preserved, hay should be properly pressed by machines. At present a sufficient number of machines are not available either with the Forest Department or with the Public Works Department Workshop for this purpose.

The ryots are not keen on silage and there is no demand for silage in rural areas. In the urban areas also silage is not popular in view of the heavy cost of transport.

As regards chaff cutters, the Agricultural Department, is already encouraging their use by advancing loans to ryots up to Rs. 100 on personal security for the purchase of these implements.

32. *Opening of rest stations along main migration routes.*—The Special Officers have recommended the opening of rest stations at regular intervals of about 10 miles along the main migration routes of coastal cattle to Cuddapah and Kurnool districts and the provision of adequate water in such rest stations. The Director of Animal Husbandry is requested to take necessary action in the matter.

33. *Legislation to minimize the depredation of goats.*—In G.O. Ms. No. 2542, Revenue, dated 20th September 1950, the imposition of fines on straying cattle has been enhanced by 25 per cent in order to reduce the menace of such cattle. The question of undertaking necessary legislation for

demanding security deposits from the owners of goats which are impounded and for forfeiting the deposits if the goats of the same owner are impounded again within six months is under the consideration of the Government.

Encouragement for keeping milch goats in Malabar.—As regards keeping of milch goats in Malabar district, the ryots are given good breeding bucks under the free distribution scheme, with a view to inducing them to keep milch goats. Arrangements have also been made to station some milch goats in the Livestock Farm at Tiruvazhankunnu (Walluvanad taluk) for breeding and distribution to the ryots.

34. *Land utilization.* The recommendations of the Government of India's experts on soil conservation are being examined and implemented to the extent possible.

35. *Rural milk supply.* The proposals made by the Special Officers in Chapter XI of their report for the increased production and distribution of milk cannot be considered in view of the present financial stringency. The Government consider that for the present, the existing arrangements with reference to G.O. Ms. No. 1269, Development, dated 29th March 1945 will suffice.

36. and 37. *Urban Milk Supply and Milk Supply Scheme for Madras.*—The remarks on recommendation No. 35 apply to these also. The Government consider that no action is necessary.

38. *Opening of a Dairy Farm in Madurai Town.* The question of opening dairy farms in big municipalities cannot be considered until the ways-and-means position of the Government improves.

39. *Formation of Sewage Farms in Coimbatore District.*—Orders on this recommendation have issued in Government Memorandum No. 43035-W2/50-I, Health, dated 1st December 1950.

40. *Planning of fodder farms in conjunction with sewage farms.*—In the city of Madras, the question of implementing the first stage of the scheme to use the sewage to grow vegetables and fodder with aid from the Government of India is separately under consideration. As regards mufassal drainage schemes, sewage grass farms invariably form part of the schemes. In Madurai municipality, the sewage grass farm is working very successfully, producing large quantities of fodder grass. The Government hope that other municipalities will follow the example of Madurai.

41. *Opening of private dairy farms.*—Owing to the difficult ways-and-means position of the Government, a scheme for the grant of subsidy to private dairy farms has been ordered to be deferred.

42. *Opening of more livestock farms.*—A scheme has been included in the Five-Year Plan of Postwar Reconstruction for the establishment of livestock farms in each district. Under this scheme, cattle farms have been set up in the South Kanara and Malabar districts. The extension of the scheme to other areas has had to be deferred in view of the present financial position of the Government.

43. *Formation of big dairy farms in the grass hills of Coimbatore district and the downs of Nilgiris.*—The Co-operative department is organizing and encouraging private people and public bodies to start dairy farms and milk supply unions. The proposal submitted by the Director of Animal Husbandry for conducting cross-breeding experiments with cattle in the Nilgiris and Hosur is under the consideration of the Government and orders in this regard will issue separately. A proposal for rearing Sindhi calves in the Siruvani Hills of the Coimbatore district was considered by Government, but dropped.

44. *Creation of a new department of land conservation to deal with all aspects of fodder, milk production and land utilization problems.*—Orders will issue separately.

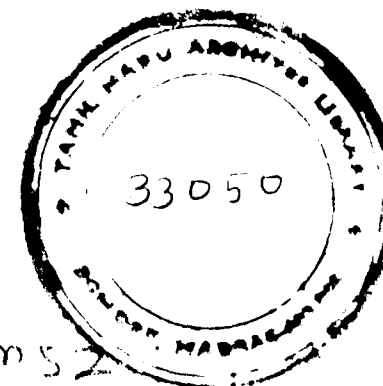
45. The Chief Conservator of Forests, Director of Agriculture, Director of Animal Husbandry, Chief Engineer (Irrigation), the Inspector of Municipal Councils and Local Boards and the Board of Revenue are requested to submit a report in due course on the action taken with reference to the orders of Government on the various recommendations of the Special Officers.

(By order of the Governor of Madras)

J. M. LOBO PRABHU,
Secretary to Government.

To the Chief Conservator of Forests, Madras.
" the Director of Agriculture, Madras.
" the Director of Animal Husbandry, Madras.
" the Registrar of Co-operative Societies, Madras.
" the Board of Revenue.
" the Chief Engineer (Irrigation), Madras.
" the Inspector of Municipal Councils and Local Boards.
" the Director of Industries and Commerce, Madras.
" the Superintendent, Government Press, Madras (for printing and supplying 200 copies of the order).
" all Collectors.
" the Local Administration Department.
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" the Food and Agriculture Department (4 copies).
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" the Rural Welfare Department.

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