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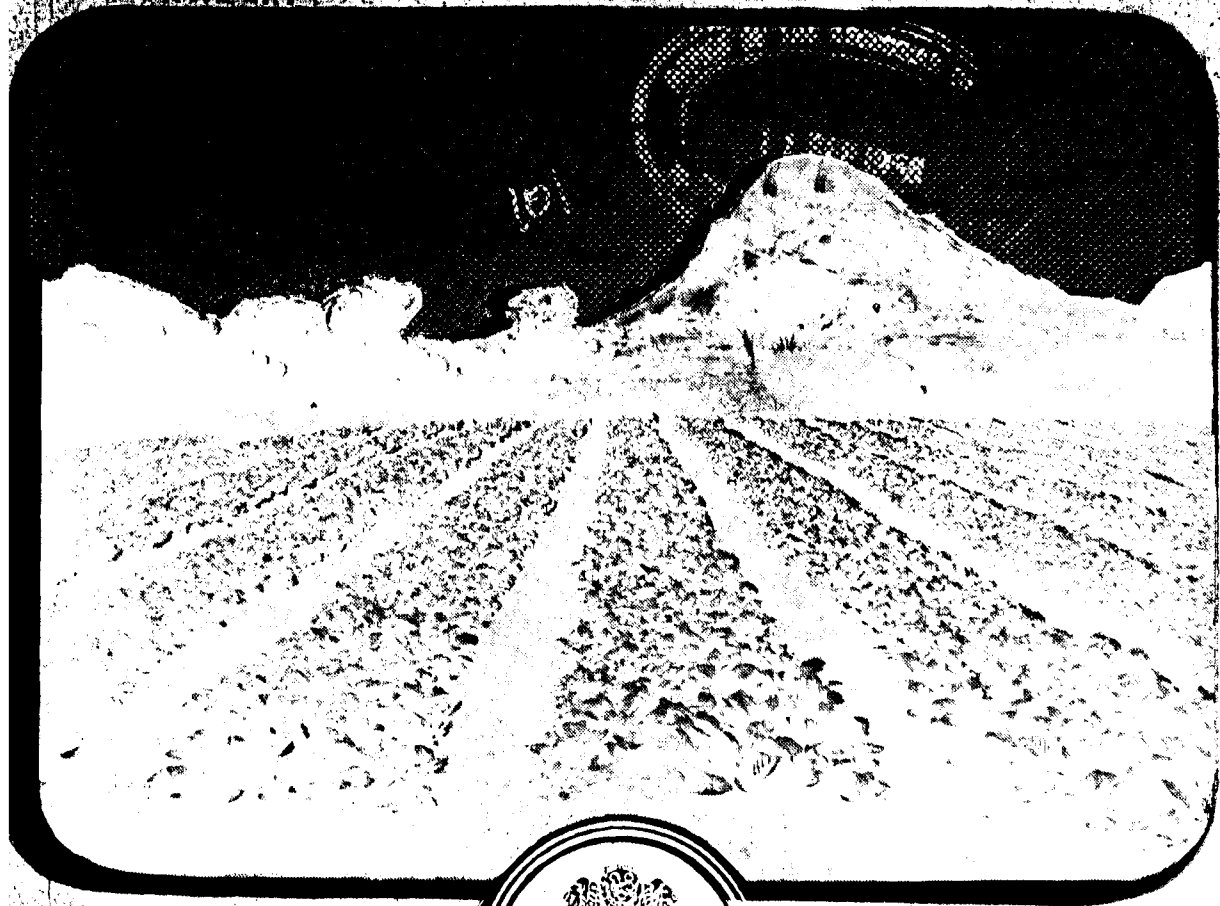
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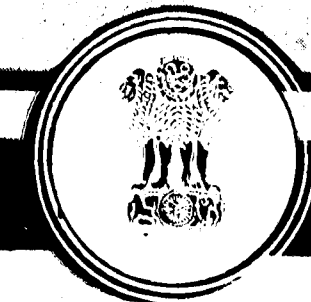


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VOLUME VIII No. 2



APRIL-JUNE 1958

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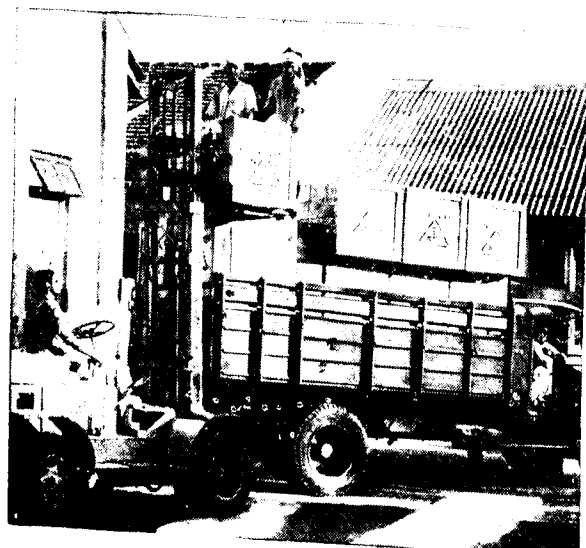
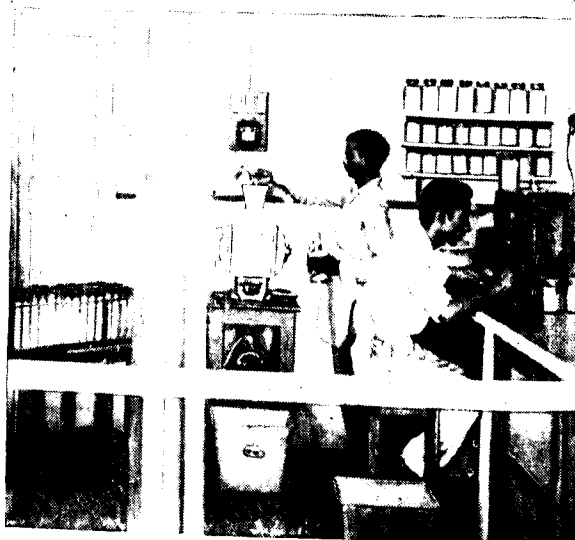
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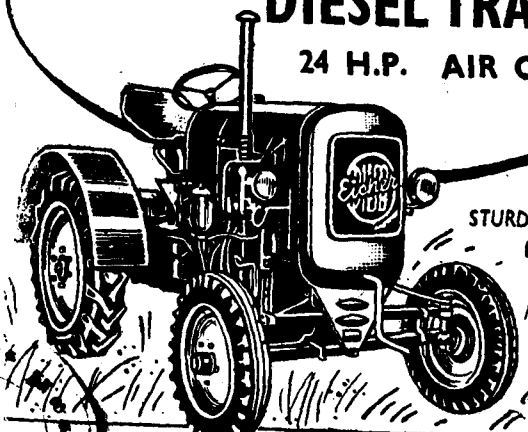
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Vol. VIII No. 2

APRIL—JUNE 1958

INDIAN TOBACCO



SHRI K. R. DAMLE, I.C.S.

Joined Indian Civil Service in 1930 ; was a District Judge in U.P. (1937-44) ; Official Secretary to the High Commissioner for India in Australia (1944-47) ; Acting High Commissioner for India in Australia (1947-48) ; Joint Secretary to the Government of India in the Ministry of Food & Agriculture (Agri.) (1949-50) ; Joint Vice-President, Indian Council of Agricultural Research, Leader of the Indian Delegation of Agricultural Extension Officials to the U.S.A. ; Vice-President, Indian Council of Agricultural Research and ex-officio Additional Secretary in the Ministry of Food & Agriculture and President of the Indian Central Tobacco Committee from November 1952 to September 1955 ; Chairman, Tariff Commission till April 1958.

Secretary to the Government of India, Ministry of Food & Agriculture (Department of Agriculture) with effect from 17th April 1958 (a.n.).

The Committee has great pleasure in welcoming him back to the Ministry.

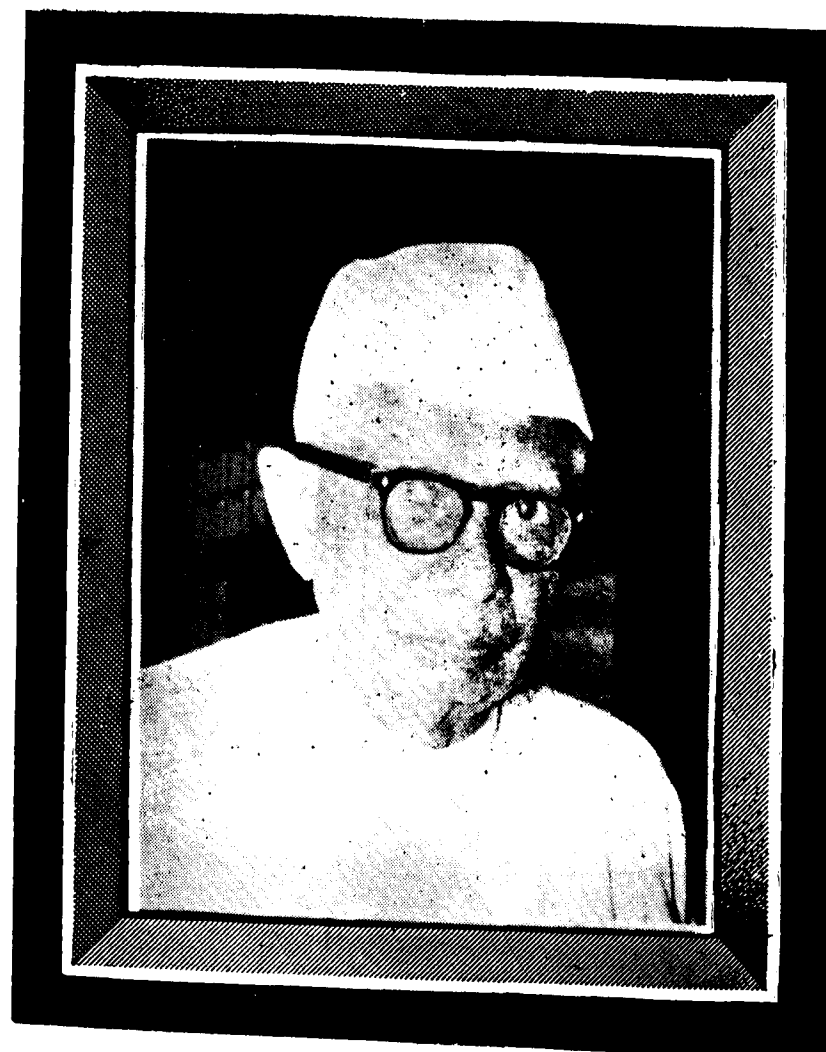


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Mysore State, and Member, Indian Central
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Growers from that State, from April 1957.



SHRI CHHOTALAL A. VYAS

Born : March 1889

Died : May 1958

A patriot, who took active part in the freedom struggle, Shri Vyas was a keen and energetic co-operator of Bombay State. He established and built up the Kaira District Central Co-operative Bank and served it as Chairman till his end. He took prominent part in establishing the Gujarat Divisional Co-operative Board and was for several years its Chairman. He made a success of the first co-operative weekly "Sahakar" in Gujarati. He was also a Director of several co-operative banking institutions in Bombay State.

He was a member of the Indian Central Tobacco Committee from April, 1955 to March, 1958 representing co-operative movement in North India. In him, the co-operative movement in India lost a veteran and an able advocate.

TOBACCO IN THE FEDERATION OF RHODESIA AND NYASALAND

The Federation of Rhodesia and Nyasaland consisting of Southern Rhodesia, Northern Rhodesia and Nyasaland was formed in 1953 and is situated within the Tropics in South Central Africa.

The cultivation of tobacco was started by the European settlers on a small scale about 60 years ago. Gradually, the farmers took interest and started growing the crop on a large scale. In the earlier years, the chief market for Rhodesian tobacco was South Africa. But due to the closure of the South African market in view of its attainment of self-sufficiency in tobacco production, the cultivation of tobacco in the Federation was somewhat restricted. However the situation improved gradually. Due to high cost of and difficulties

Federation during 1957 is estimated at about 175 million lbs. i.e., about 34 million lbs. below the record level reached in 1956. Flue-cured tobacco at 147 million lbs. in 1957 was less than the previous year's crop by about 31 million lbs. The output of dark fire-cured also declined by nearly 3 million lbs. Despite the lower level of output during 1957, total tobacco production is still four times as great as before the war, mainly because of the great expansion of production in Southern Rhodesia which provides about four-fifths of the total. As regards Nyasaland, the production of tobacco for the year 1957 at 31 million lbs. remains close to the annual average for the period 1950-56. In North-Eastern Rhodesia, there has been a marked decline.

DR. M. S. PATEL, M. Sc., Ph. D. (N. Carolina)

Secretary, Indian Central Tobacco Committee.

in importing U.S.A. tobacco during war-time and also to meet the increased demand chiefly from U.K. due to dollar shortage etc. the cultivation of tobacco was again started in the Federation on a very large scale.

Tobacco plays a very prominent role in the over-all economy of the Federation and ranks second to minerals in yielding returns. More than 90% of the tobacco produced is exported which represents over three-fourths of the Federation's total agricultural exports. She is now one of the most important suppliers of tobacco to the international trade.

Cultivation

Flue-cured tobacco is the most important type of tobacco grown in the Federation. Next in importance are the dark-fire-cured and sun-cured tobaccos. Tobacco production in the

A table showing the production of the different types of tobacco in the Federation of Rhodesia and Nyasaland during 1950 to 1957 is given in Appendix I.

It is estimated that about 90% of the Federation's flue-cured tobacco is grown in Southern Rhodesia. The production of tobacco in Southern Rhodesia during the year 1957 was placed at 143.1 million lbs. from an area of 194.7 thousand acres. Most of the tobacco produced in Northern Rhodesia is flue-cured but some burley, turkish and dark sun/air-cured are also grown. Recently flue-cured tobacco alone has accounted for more than 95% of the total tobacco grown. About 6% of the Federation's flue-cured tobacco is grown in N. Rhodesia. Usually she produces about 7 to 10 million lbs. of Flue-cured Virginia tobacco.

In Nyasaland flue-cured tobacco production has been rising and has averaged 3-4 million lbs. annually in the recent past. The crop season starts in August and ends by about March. During August, seed beds are established and watering is done usually by hand till the seedlings are large enough for transplantation. During the months of April to October there is practically no rain. Transplanting is usually spread over from the month of October to December. This is done mainly to reduce the weather risk and also to spread the harvest and curing time over a long period.

Production of Turkish tobacco in Southern Rhodesia was at its peak in 1945-46 and 1946-47 after which there was a drastic reduction. This sharp decline has been however followed by recent increases but the output is still below the mark to attract buyers who wish to export it in large quantities. Transplanting of Turkish tobacco is carried out usually during January and February so that the leaf can be harvested after termination of the rainy season. Turkish leaf is sun-cured and therefore subject to damage if exposed to rain.

In Northern Rhodesia, Turkish tobacco which is next in importance to Flue-cured tobacco is grown on European farms. Turkish tobacco is not grown in Nyasaland.

As regards dark fire-cured tobacco, only a small quantity is produced in Southern Rhodesia. Only very negligible quantity of fire-cured leaf is grown in Northern Rhodesia. Dark fire-cured is an important type in Nyasaland and about 95% of the Federation's dark leaf is produced here. Production of this type in 1957 amounted to 22.7 million lbs.

Nyasaland is the only producer of dark sun-cured in the Federation. Most of the production is on estates but a large amount is also grown on Native Trust Land. Nyasaland produced 3.4 million lbs. of sun-cured tobacco in 1957.

A small amount of burley tobacco is grown in the eastern part of Northern Rhodesia and recently in Southern Rhodesia.

Burley crop is produced in the Lilongwe area in Nyasaland. Almost the entire crop of the Federation is from this part only. The leaf is usually a heavy red type used primarily for smoking and chewing tobaccos.

Marketing

All tobacco except the Turkish type grown in Southern Rhodesia and North-Western part of Northern Rhodesia is sold by auction at Salisbury. The system of auction was introduced in 1936 at Southern Rhodesia. Salisbury is considered to be one of the biggest tobacco markets in the world and the system of auction sales adopted here is more or less similar to that in America.

At present there are three auction floors at Salisbury namely Tobacco Auction Ltd., Tobacco Producers' Floor Ltd., and Tobacco Sales Ltd. The auction floors as well as buyers are licensed on payment of fees. The farmers can send their bales to anyone of the three auction floors, convenient for them. A quota of maximum delivery is fixed at the auction floor on bi-weekly basis for each grower in order to prevent congestion at the floors. Usually the quota is fixed on taking into account of the grower's production during the previous 5 year period.

The leaf is baled on the farm or in commercial grading sheds and shipped to the auction floors for sale in this form. Facilities for redrying are provided in the area. Auction commences in about the middle of March and continues upto September or October. For the auction sale, bales are arranged according to groups in long straight parallel rows along the auction floor. To each bale, the owner of the auction floor attaches a label of his own and the bale is kept open to allow examination of the leaf by the buyers. The auction takes place under the supervision of a sale supervisor.

Turkish tobacco is sold by the farmers locally to individual merchants either by himself or through co-operatives.

The prices received for flue-cured tobacco produced in the eastern area of Northern Rhodesia have been fairly low in relation to prices received in Southern Rhodesia. The average prices of fire-cured are always much lower than those for flue-cured tobacco.

From the auction floor, tobacco is exported mostly in bales but a considerable amount is shipped in boxes or hogsheads containing upto 1000 lbs. Most of the tobacco for export moves by rail from Salisbury to ports where it is loaded on ships to different countries.

There are two large auction warehouses in Limbe and leaf tobacco is handled in bales as in Southern and Northern Rhodesia. The dark tobacco on Native Trust Land is produced under the direction of and purchased by the African Tobacco Board. The Board grades and bales the dark leaf and sells them on the Limbe auction. The growers are paid by the Board according to the quality of the leaf. Most of the quantity for export move by rail from the auction floors to the nearest ports.

Consumption and exports

Only about 5% of the total production in the Federation is utilised for home consumption and the rest is exported. She is a formidable competitor to other flue-cured and fire-cured producing countries. Rhodesian tobacco is exported to about 40 countries. The most important importers of Rhodesian tobacco are the commonwealth countries, especially the U.K., Australia, the Union of South Africa, etc. The non-commonwealth importers are the Netherlands, West Germany, the Belgian Congo, Belgium, Egypt, Denmark and Sweden etc. Agreements are made with countries which guarantee specified minimum level of shipments provided the required and desired grades are available for export at reasonable rates. Export position to that extent is thus stabilised.

The Tobacco Advisory Committee to the Board of Trade by arrangement with the Rhodesian Tobacco Marketing Board provides estimates each year of U.K. requirements from the southern and North-Western Rhodesian flue-cured crops in each of the next three years subject to availability, quality, and price. The estimated figure for the years 1958 to 1960 is 85 million lbs. for each year; but these estimates are subject to revision.

A bilateral trade agreement exists with Australia guaranteeing the purchase by that country of 9.7 million lbs. of tobacco annually or 6½% of the crop whichever is less with continued preferential tariff treatment for this tobacco.

An arrangement with the Union of South Africa under terms of which a minimum of 2 million lbs. of tobacco is permitted to enter annually into the Union duty-free with a further provision that the quantity may be increased as conditions warrant. The total quantity to be admitted duty-free for each year

apart from the minimum as set forth in the agreement depends largely upon the supply situation in the Union. The effect of this proviso is to furnish the tobacco producers of Rhodesia with a virtually guaranteed outlet for variable quantities of leaf, on a preferential basis. Imports of tobacco into the Union from the Federation consist largely of flue-cured leaf produced in Southern Rhodesia.

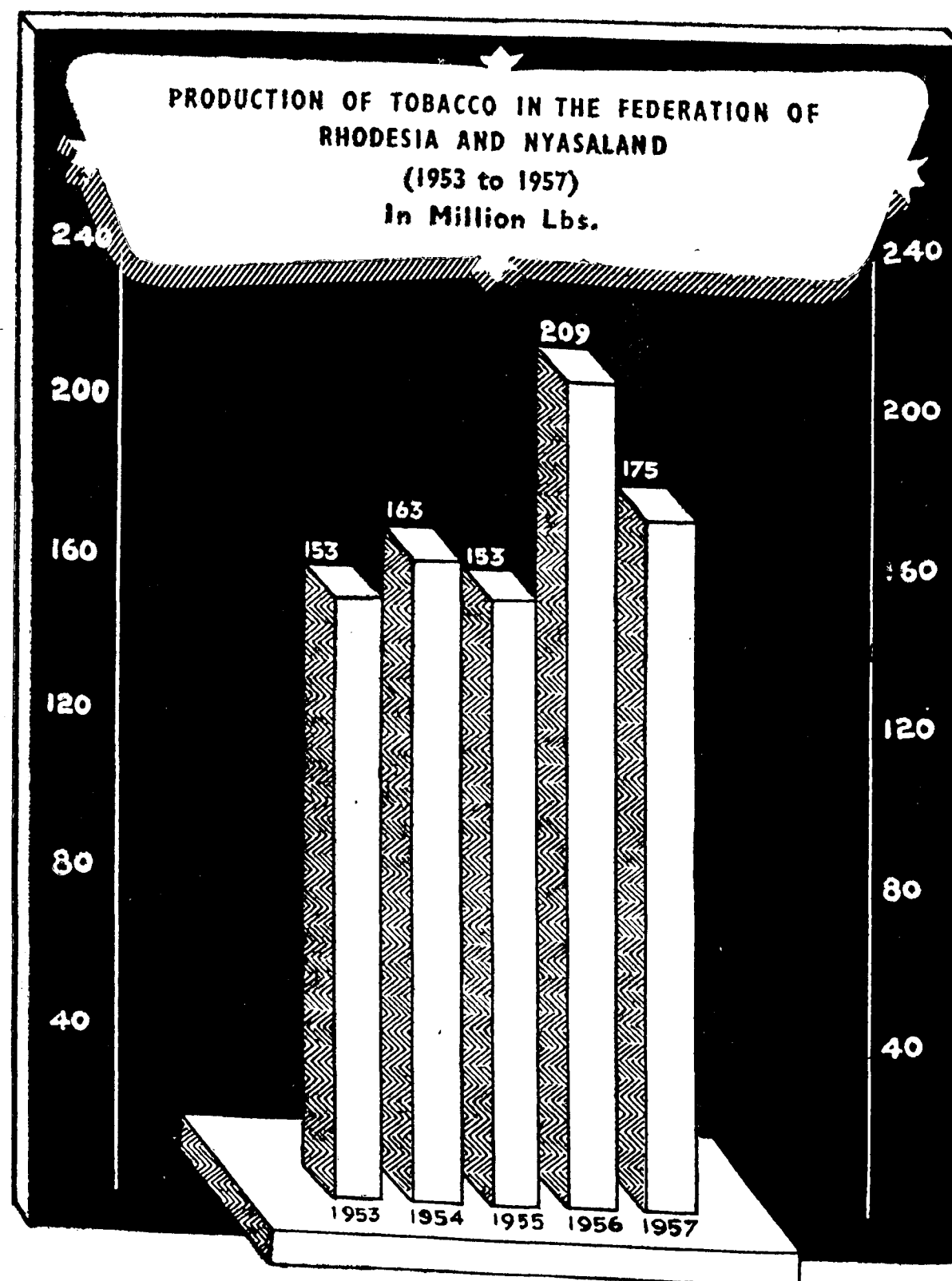
Exports of unmanufactured tobacco from the Federation during the year 1957 amounted to 139 million lbs. about 26 million lbs. less than that in 1956. Flue-cured tobacco alone accounted for four-fifths of the total, most of the remainder being fire-cured. United Kingdom consumed 76.8 million lbs. which were about 10.9 million lbs. less than the previous year's in-take. As regards Union of South Africa, its import from the Federation dwindled to 3.4 million lbs. during 1957 as compared to 17.6 million lbs. in 1956. Exports to Australia on the other hand have gone upto 9.0 million lbs. which were 0.5 million lbs. more than those during the year 1956. Exports to the four chief foreign markets viz., Western Germany, Netherlands, Belgium and Belgian Congo during 1957 were 8.5 million lbs., 7.5 million lbs., 5.7 million lbs. and 6.3 million lbs. respectively as compared to 3.5 million lbs., 13.2 million lbs., 6.3 million lbs. and 6.9 million lbs. during the previous year.

A statement showing the exports of unmanufactured tobacco by types from the Federation during 1953 to 1957 and a statement showing country-wise details of exports for the year 1957 are given in Appendices II and III respectively.

Tobacco Research Board of Rhodesia & Nyasaland

The tobacco industry in the Federation is carrying on intensive research and extension programmes in an effort to raise the quality and yield of tobaccos, particularly flue-cured. The Southern Rhodesia Tobacco Research Board which had been in operation since 1950, was superseded in 1955 by the Tobacco Research Board of Rhodesia and Nyasaland. This Board is composed of representatives of the growers, and tobacco traders and the Federal Government.

There are two main research stations, one at Kutsaga and the other at Trelawney. Both are located near Salisbury, Southern Rhodesia.



Dr. M. S. Patel

The Kutsaga station is working on the control of diseases and nematodes, breeding, soil and fertiliser insect control studies as well as other chemical investigations. The other station is doing primarily seed bed and field plot work with flue-cured tobacco and also experiments on Oriental tobacco.

During 1956 a trade delegation was sent to the Far East, Australia and New Zealand to explore the possibilities of increasing the

Federation's exports to these countries. Again a Government official visited these countries with a view to investigate closely the opportunities for the sale of tobacco on a reciprocal trade basis and also for the establishment of a Trade Commissioner to cover these countries. The above sources are reported to have collected very valuable information in this regard which will be made use of by the Federation in the furtherance of their tobacco exports.

APPENDIX I

Production of the different types of tobacco in the Federation of Rhodesia and Nyasaland during 1950 to 1957
(Thousand lb. dry weight)

Types			Southern Rhodesia	Northern Rhodesia	Nyasaland	Federation total
Flue-cured	1950	...	105,492	6,171	2,605	114,268
	1951	...	90,726	10,776	4,043	105,445
	1952	...	98,969	9,523	3,519	112,011
	1953	...	105,967	10,324	3,735	120,026
	1954	...	120,874	7,985	4,306	133,165
	1955	...	121,931	7,606	3,694	133,231
	1956	...	171,630 (a)	1,979 (d)	4,090	177,699
	1957	...	143,000 (a)	1,200 (d)	2,637	146,837
Fire-cured	1950	...	1,241	...	24,024	25,265
	1951	...	712	...	25,394	26,106
	1952	...	635	...	12,556	13,191
	1953	...	368	...	24,362	24,730
	1954	...	604	...	23,599	24,203
	1955	...	279	...	14,782	15,061
	1956	...	342	...	22,299	25,641
	1957	...	95	...	22,697	22,792
Burley	1950	...	...	327	807	1,134
	1951	...	...	253	1,354	1,607
	1952	...	...	124	1,002	1,126
	1953	...	...	107	1,691	1,798
	1954	...	...	101	1,949	2,050
	1955	...	...	157	2,017	2,174
	1956	...	...	187	2,272	2,459
	1957	...	...	N.A.	2,066	2,066 (e)

Tobacco in the Federation of Rhodesia and Nyasaland

APPENDIX I—(contd)

Types		Southern Rhodesia	Northern Rhodesia	Nyasaland	Federation total
Sun/air-cured	1950	...	43	4,422	4,465
	1951	...	50	5,348	5,398
	1952	...	25	3,000	3,025
	1953	...	20	6,286	6,306
	1954	...	11	3,299	3,310
	1955	...	6	2,324	2,330
	1956	...	14	2,676	2,690
	1957	...	N.A.	3,417	3,417 (e)
Turkish	1950	276	115	...	391
	1951	99	49	...	148
	1952	159	50	...	209
	1953	127	30	...	157
	1954	149	37	...	186
	1955	233	150	...	383
	1956	460	250	...	710
	1957	N.A.	N.A.	...	N.A.
Total all types	1950	107,018 (b)	6,656	31,858	145,532
	1951	91,558 (b)	11,028	36,139	138,725
	1952	99,770 (b)	9,722	20,077	129,569
	1953	106,464 (b)	10,481	36,074	153,019
	1954	121,627 (b)	8,134	33,153	162,914
	1955	122,446 (b)	7,919	22,817	153,182
	1956	172,432 (a) (c)	2,430 (d) (e)	34,337	209,199 (c)
	1957	143,095 (a) (c)	1,200 (d) (e)	30,817	175,112 (c)

Note: The above table is based on production estimates or when these are not available on the amounts sold at auction.

N.A. = Not available.

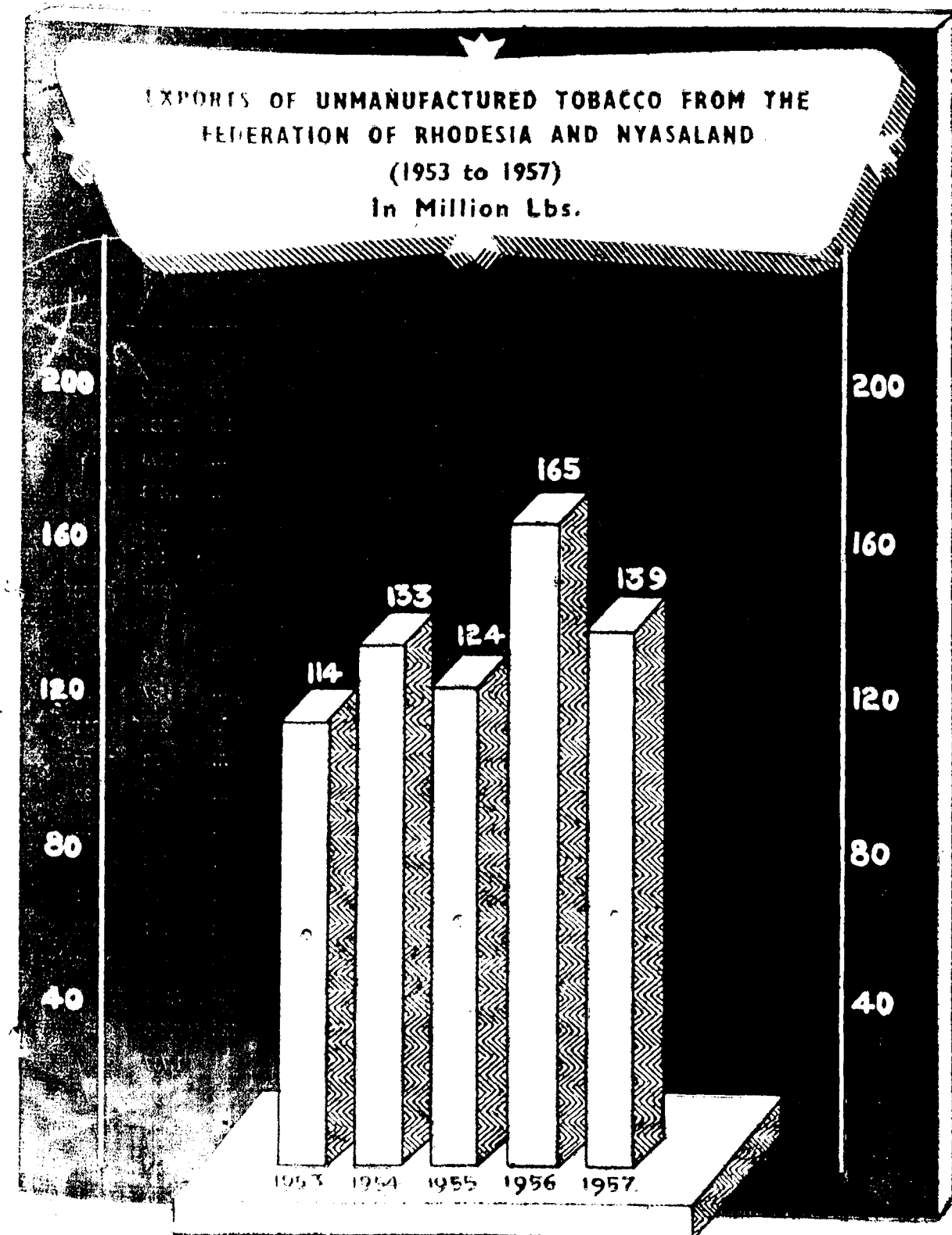
(a) Estimates for North-Western Rhodesia flue-cured included with that for Southern Rhodesia.

(b) Including small quantities of unspecified varieties.

(c) Subject to revision, excluding small quantities of some minor varieties.

(d) North-Western Rhodesia flue-cured only.

(e) Incomplete.



Tobacco in the Federation of Rhodesia and Nyasaland

APPENDIX II

Exports of unmanufactured tobacco by types from the Federation to different countries during 1957

(Thousand lb. dry weight)

Destination	Flue-cured tobacco			Dark fire-cured tobacco			Other types	Total all types	Total during 1956
	Leaf	Strip-ped and scrap	Total	Leaf	Strip-ped and scrap	Total			
United Kingdom ...	36,076	31,546	67,622	4,017	3,027	7,044	2,093	76,759	67,649
Australia ...	7,894	1,003	8,897	56	...	56	35	8,988	8,536
Union of South Africa ...	3,025	...	3,025	1	1	2	409	3,436	17,618
Nigeria ...	1,463	...	1,463	10	...	10	...	1,473	1,141
Sierra Leone ...	...	...	...	1,468	...	1,468	...	1,468	1,920
Gambia ...	...	...	...	388	...	388	...	388	145
Bechuanaland ...	...	...	...	164	...	164	...	164	100
Hong Kong ...	1,616	170	1,786	...	...	...	119	1,905	1,358
Malaya and Singapore ...	238	592	830	...	...	...	...	830	850
Bahrain ...	...	72	72	...	10	10	3	85	96
Mauritius ...	57	...	57	...	...	...	...	57	31
Cyprus ...	226	26	252	...	...	...	...	252	311
Gibraltar ...	...	...	...	10	22	32	...	32	75
Malta ...	2	...	2	26	...	26	...	28	32
Canada ...	182	610	792	...	...	...	...	792	...
British West Indies ...	88	145	233	10	...	10	...	243	504
Other Commonwealth ...	9	30	39	...	...	...	...	39	1
Irish Republic ...	242	86	328	80	191	271	2	601	347
Western Germany ...	8,387	70	8,457	15	...	15	110	8,582	3,484
Netherlands ...	4,457	1,224	5,681	1,661	38	1,699	124	7,504	13,190
Belgium ...	3,477	1,880	5,357	44	130	174	122	5,653	6,324
Denmark ...	539	1,128	1,667	7	22	29	41	1,737	2,117
Norway ...	1,182	...	1,182	...	...	...	510	1,692	974
Sweden ...	...	518	518	...	407	407	...	925	1,735
Austria ...	730	193	923	...	...	...	...	923	731
Portugal ...	280	378	658	...	...	...	31	689	634

Dr. M. S. Patel

APPENDIX II—(contd).

Exports of unmanufactured tobacco by types from the Federation to different countries during 1957—(contd.)

(Thousand lb. dry weight)—contd.

Destination	Flue-cured tobacco			Dark fire-cured tobacco			Other types	Total all types	Total during 1956
	Leaf	Strip-ped and scrap	Total	Leaf	Strip-ped and scrap	Total			
France ...	553	...	553	...	...	...	...	553	466
Switzerland ...	272	...	272	...	130	130	...	402	325
Finland ...	50	...	50	157	...	157	...	207	97
Belgian Congo ...	1,860	319	2,179	3,766	193	3,959	207	6,345	6,949
French Africa ...	513	44	557	1,307	...	1,307	161	2,025	2,283
Canary Islands ...	...	...	...	1,376	185	1,561	...	1,561	1,488
Portuguese Oversea Provinces ...	161	135	296	1,013	...	1,013	38	1,347	1,187
Liberia ...	...	...	...	494	...	494	...	494	432
Egypt ...	110	...	110	136	...	136	...	246	714
United States ...	7	...	7	1	...	1	275	283	153
Indonesia ...	...	...	...	...	...	...	...	...	738
Other Foreign ...	115	25	140	95	...	95	5	240	383
Total ...	73,811	40,194	114,005	16,302	4,356	20,658	4,285	138,948	165,118

APPENDIX III

Exports by types from the Federation during 1953 to 1957

(Thousand lb. dry weight).

Calendar year	Flue-cured tobacco			Dark fire-cured tobacco			Other types	Total all types
	Leaf	Strip-ped and scrap	Total	Leaf	Strip-ped and scrap	Total		
1953 ...	74,697	14,936	89,653	14,873	3,136	18,009	6,199	113,860
1954 ...	81,240	27,234	a 108,497	15,365	3,545	18,910	5,078	a 132,485
1955 ...	82,438	24,164	a 106,463	10,733	3,319	a 14,069	a 3,639	a 124,171
1956 ...	105,806	33,526	a 139,056	17,609	4,393	a 22,042	4,020	a 165,118
1957 ...	73,811	40,194	114,005	16,302	4,356	20,658	4,285	138,948

Note: (a) Amended totals; details not available.

Courtesy: (1) Tobacco Intelligence Vol. 9, No. 3 August, 1957 and Vol. 10, No. 1 February 1958.

(2) Foreign Agricultural Reports, U.S.D.A. November 1956.

(3) Foreign Agriculture Circulars, U.S.D.A. September 1954.

SHRI KALIDAS SAWHNEY, M.Sc., F.N.I.

Shri Sawhney who died in March 1958 at the age of 61 years had, after serving as a professor in Peshawar and Delhi and in the Department of Agriculture Iraq, joined the Department of Agriculture of the former Hyderabad State in 1929. As the Director of Agriculture of that State, Shri Sawhney was a member of the Indian Central Tobacco Committee during 1945 to 1948. Leaving Hyderabad, he served as Secretary, Indian Central Cotton Committee and Agricultural Adviser to the Community Projects Administration and also acted as Honorary Regional Agricultural Production Commissioner, Ministry of Food and Agriculture, Government of India.

The country has thus lost an experienced agricultural scientist.

WORLD AGRICULTURE FAIR NEW DELHI

December 1959 to February 1960

The Bharat Krishak Samaj, which is the national organisation of Farmers of India, has decided to hold a World Agriculture Fair from December 1959 to February 1960. All countries in the world, various Ministries of the Government of India, State Governments, Associations connected with farmers and rural India, manufacturers, importers and dealers of agricultural and food processing machinery in India and abroad are being requested to participate in the Fair which will be the first of its kind in the history of the world to be held on an international scale.

Holding of the Fair was announced in New Delhi on June 27, 1958 by Shri Ajit Prasad Jain, Union Minister of Food & Agriculture, before a distinguished gathering consisting of Ministers of the Government of India, diplomats and officers and experts of the various Ministries of the Government and representatives of the trade and press.

HOOKAH AND CHEWING TOBACCOS OF NORTH BENGAL

I. GROWING AND CURING*

The cultivation of tobacco in West Bengal is mainly concentrated in the Northern districts of Cooch Behar and Jalpaiguri. From the available account (1953) it appears that tobacco was under cultivation in Cooch Behar district as early as 1810.

The varieties of tobacco grown in this region are known as Jati (*N. tabacum*) and Motihari (*N. rustica*). Both are used for hookah and chewing purposes and grow at their best in certain areas reputed for the production of

the problems confronting the tobacco growers, a survey was undertaken during the year 1956-57. The important tobacco growing villages in Adabari and Okrabari tracts and in the sub-division of Mathabhanga were specially visited for the purpose.

Area and Production :

Of the total acreage of about 40,000 under tobacco in the State about 24,000 acres are

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quality leaf. In the district of Cooch Behar, Adabari area is highly reputed for its best quality Jati tobacco; whereas Okrabari area is noted for Motihari. Both these areas are located in the Dinhata sub-division. Cooch Behar Sadar and Mathabhanga sub-divisions are also important for tobacco production in the district.

With a view to find out the prevalent cultural practices and to gain first-hand knowledge of

occupied by the varieties of *N. rustica* and about 16,000 acres by those of *N. tabacum*. The present Central Excise Division of Cooch Behar which covers the entire district of Cooch Behar (excluding Haldibari P.S.), and some adjoining areas of Jalpaiguri district accounts for over 34,000 acres of the total tobacco acreage in the State. The statistics about area, production, etc., of this division are given in Table 1.

*Part II—'Marketing' will appear in a subsequent issue.

† Now Agronomist, Central Tobacco Research Institute, Rajahmundry.

TABLE 1.

Area, Production, etc., in Cooch Behar Division

Year		Number of growing villages	Area	Number of growers	Number of curers*	Production	Yield per acre
			ACRES			LBS.	LBS.
1953-54	...	1,347	34,196	63,837	57,336	19,453,441	569
1954-55	...	1,319	36,676	67,081	59,734	25,705,679	701
1955-56	...	1,344	35,368	72,738	63,584	23,559,722	666
1956-57	...	1,322	32,765	74,101	60,676	20,084,270	613
1957-58	...	1,327	35,169	73,421	61,675	Not available	...
Mean	...	1,332	34,835	70,236	60,601	22,200,778	637

* Growers cultivating tobacco on a small area for personal consumption are excluded from this class.

Soils :

The soils of the Cooch Behar district are of alluvial formation and contain a large proportion of sand. Tobacco is grown on soils ranging from light sandy to medium silt loams. High-lying lighter soils found on both the banks of river Singimari in Adabari area are well suited for jati tobacco, whereas, medium silt loams and fairly low-lying soils are put under motihari tobacco. The chemical analysis of the surface soil (oven dry basis) from Dinhata sub-division is given below.

	PER CENT
Nitrogen	...
P ₂ O ₅	...
K ₂ O	...
pH	...

(analysed by the microbiologist, West Bengal and reproduced in the District Hand Book of Cooch Behar).

Varieties :

The varieties under cultivation in the case of Jati tobacco are known locally as Chama, Podali, Hasti Karan, Darasmoni, Kadam-dali and Deshi. Chama variety is by far the most prominent and is extensively grown in the Adabari-Gosanimari area. Cultivation of Podali is mainly concentrated in the village Natabari while Hastikaran is grown in Matha-bhanga area. Cultivation of Deshi is sparsely found in the Motihari growing areas in small patches.

In case of Motihari tobacco, the varieties are locally named as Hemti (Late) and Britri (Early) in the Okrabari area and in the rest of the sub-division of Dinhata. In the Matha-bhanga sub-division the different varieties are locally termed as Zapsi, Bilayati, Tangua and Bombai.

Rotation :

In the sandy soils of jati growing tract of Adabari, farmers leave the land fallow after tobacco harvest in February-March. In the

Kharif season, the fields are covered with weeds and grazed by cattle. One obvious advantage of this practice is the prevention of soil erosion during the Khariff season when rainfall is very high. Cultivation of these fields is again resumed in August for the next tobacco crop.

In the motihari growing areas tobacco lands are mostly double cropped. After the harvest of tobacco in January-February, the land is put either under Aus paddy (early kharif paddy) or jute. Leaving the land fallow is not much in vogue. After the harvest of Aus paddy or jute in July-August some farmers occasionally utilize portions of their lands for raising Aman paddy seedlings. The same land in rabi are put under tobacco. Thus the usual rotational practice is tobacco (Rabi)—Aus paddy or jute (Kharif).

Nursery :

(a) *Location* : In the vicinity of the home-stead, a high location having good natural drainage is selected in the corner of a nearby field as the site for tobacco nursery. In the Jati growing areas, where nursery raising commences earlier, more than one site is selected. Jati nursery sites are usually left fallow in preceding months whereas vegetables are usually grown in the case of Motihari nursery sites. The same locations are used year after year.

(b) *Preparatory tillage* : The preparatory tillage operations consist of ploughing, planking and hand raking. The ploughing is done with a wooden country plough which penetrates to a depth of about 4".

Each ploughing is followed by two or more plankings depending upon the condition of the soil and amount of weed growth. The area after planking is raked and weeds etc., are collected and removed. The ploughing followed by planking is done at 2 to 3 days intervals depending upon weather and soil conditions. On an average about 14 to 16 ploughings, each followed by at least 2 plankings are given to bring the soil to the desired tilth. The preparatory tillage operations are commenced during June-July for Jati nursery and August-September for Motihari Nursery.

(c) *Manuring* : Only farmyard manure is in use. The quantity used varies from farmer to farmer and from area to area. Use of raw

dung is the unique practice in the Jati tobacco growing villages of Adabari area. Many farmers in this area do not have a manure pit at all, and all the year round the raw dung is directly put into the fields even when the tobacco crop is standing (Fig. 1). Cow dung is in very high demand and resourceful farmers own and maintain large herds of cattle just for dung collection. The raw dung application to the nursery lands is done between January and March. The quantities applied are enormously high. The common practice is to heap basketfuls of raw dung (approximately 30 lbs. each) close to each other over the entire nursery land. The heaps are left as such and the rotten manure gets mixed with the soil at the time of preparatory cultivation.

In Motihari area, well rotten farmyard manure is applied to nursery lands that were cropped with vegetables during the Kharif and cleared in time for nursery raising. In nursery sites which are left fallow during Kharif, application of raw dung or tying of cattle is occasionally practised. Manure application is usually done in the month of September. It is estimated that about 40 to 50 cart-loads of F.Y.M. per acre are applied to the Motihari nursery lands.

(d) *Size and shape of beds* : Usually the size and shape of the beds vary with different farmers depending upon the location and slope of the land. For Jati tobacco, the beds are 15' to 20' long and 4' to 5' wide with 3" to 4" deep drains all around. The general practice for motihari tobacco is to treat the entire nursery area as one big flat bed with water exit points wherever necessary.

(e) *Seeding of beds* : Nursery sowings for jati tobacco are commenced by the middle of August and continue upto the first week of September. For Motihari Tobacco sowings start during last week of September and continue during the first week of October. The seeds are mixed with fine dry powdered earth or sand to increase the bulk and the mixture is uniformly sprinkled over the bed. The quantity of seed sown usually depends upon the judgment of the farmer. As a result the seed rate is excessively high. The estimated seed rate comes to 6 to 8 lbs. and 10 to 12 lbs. per acre of nursery for jati and motihari tobaccos respectively. After seeding, the surface soil is lightly mixed and pressed with hands in the case

of jati tobacco, whereas in motihari tobacco, the bed is planked with a very light pressure.

(f) *Care of Nursery beds* : Usually the beds are not watered immediately after sowing. In later stages of growth, light waterings are given whenever required. The application is always done during the evening hours with bamboo made syringes. If the growth and vigour of the seedlings are found to be unsatisfactory, powdered F.Y.M. is sprinkled over the beds before watering. The nursery beds are usually not covered. However, in Mathabanga sub-division a thin layer of *aus paddy* straw is usually spread on the beds immediately after sowing. About two weeks after seeding whatever straw is still left undecomposed is removed from the beds at the time of first weeding. Depending upon the amount of weed growth 3 to 4 weedings are given and thinning of beds is also done simultaneously. The seedlings of jati and motihari get ready for transplanting 6 to 7 and 4 to 5 weeks respectively after sowing.

(g) *Diseases and pests* : Damping off (locally known as jain, khaithar and pacharog) is occasionally met with. Leaf eating insects, caterpillars and cut worms also damage the nursery. Another insect locally known as *ghugri* damages the seedlings by burrowing under the surface. Usually no remedial measures are taken for damping off except withholding watering and cleaning of rotten patches attacked by the disease. For the leaf eating caterpillars hand picking is resorted to.

(h) *Miscellaneous* : Every farmer produces his own seeds by retaining a few untopped plants in the nursery itself. The seeds when ready are collected, cleaned, dried and stored in glass bottles or in the hollow of a dry bamboo. Practice of sale and purchase of seedlings is not known and if required seedlings are obtained from neighbours and friends free of cost.

In general, putting of larger area under nursery than required, periodic sowings at different locations, heavy application of farmyard manure, judicious watering, frequent weedings and stirring with little or no precaution for the control of diseases and pests are the chief features of the nursery (Poolibadi) management of this tract.

Preparation of the Land :

Soon after the nursery sowing, preparatory cultivation of tobacco lands is taken up. In

the case of Jati tobacco ploughing is commenced during August-September and for Motihari during September-October. Usually 12 to 15 ploughings are given at intervals, each followed immediately by two or more crosswise plankings. The planking of the ploughed fields is done after leaving the land exposed for a few hours. This helps in the better crushing of the soft clods and in the collection of weeds. During planking the weeds, stubbles, etc., get collected at places. These are then manually removed. The operation is repeated till the field is free from clods and weeds and fine tilth is obtained. If still some clods remain in the fields they are broken by manual labour. Thus the number of plankings given after each ploughing depends more on the conditions of the soil and roughly ranges from 1 to 3 crosswise plankings. Intensity of plankings gradually decreases as the preparations advance.

Manuring :

Raw dung is applied to tobacco fields in the jati growing villages of the Adabari area. The quantity applied is enormously high. Usually one basket of raw dung is dumped approximately at intervals of 3' to 6'. The estimated rate of application in terms of rotten F.Y.M. ranges from 25 to 75 cart-loads per acre. Use of green manures, compost and artificial fertilizers is completely unknown. The general belief prevailing amongst the farmers is that use of F.Y.M. alone gives a good yield and good quality crop. As mentioned earlier, large herds of cattle are being maintained by resourceful growers to increase their supplies of dung.

In the case of Motihari tobacco application of F.Y.M. is not so high. About 20 to 30 cart-loads of well-rotten F.Y.M. are applied per acre prior to the last 4 to 5 ploughings. The manure is heaped in small quantities throughout the field, evenly spread with hands and ploughed in. At the time of planting a handful of powdered F.Y.M. may be applied by some farmers at the spots where the seedlings are to be planted. Use of green manure is absent. However, fertilizer-manure mixture at the rate of 3 to 6 maunds per acre is applied broadcast by resourceful farmers.

Transplanting :

For planting jati, late September to early October is considered to be the optimum period

but plantings continue late in October depending upon weather conditions and availability of seedlings. In the case of Motihari tobacco, transplanting is commenced during last week of October and continues upto the end of November.

After the preparation of the field, marking of rows is taken up. The common method of marking could be termed as a *foot and string method*. A string longer than the length of the field is taken. Each end of the string is secured to a bamboo peg whose length is equal to the desired spacing between two rows. One peg is first fixed at the head of the first row and the string stretched straight along the length side of the field leaving the required space between the edge of the field and the first proposed row. The operator holds the other end of the string and gets ready for marking from the opposite end. Before commencing the marking, the peg tied to the other end of the string is fixed at the head of the second row without disturbing the string which is lying on the first row being marked. The first row is then marked by dragging the foot along the string looking straight ahead and holding and slowly passing the string. After reaching the other end the peg fixed on the first row is removed, the position of the second row is located, string is stretched straight on the second row, the peg removed from the head of the first row is fixed on the head of third row and the marking of the second row is commenced. The entire field is thus marked lengthwise. This process of marking requires only one man. For spacing within the rows either a bamboo splinter of the desired length is employed or the transplants are spaced approximately by judgment.

Prior to the pulling of seedlings, nursery beds are given light watering during morning hours and the pulled seedlings are immediately removed to the shade. Transplanting is done in the afternoon when the sun is not so strong. The spot where the seedling is to be transplanted is thoroughly worked with a khurpi (Pasun). The soil is then made firm by pressing with the khurpi and a sufficiently wide slit-like opening is made by inserting the blade in the soil and pressing it sideways (Fig. 2). A seedling is then picked from the basket, placed in the opening and the soil pressed back. If the tap root is too long, its extra length is pruned on the spot with the khurpi. No watering is done after planting. Two to three gap fillings at an

interval of 5 to 6 days are carried out. The spacing within the row and between the rows is uniform and ranges from 3' to 3½' in the case of Jati and 2½' to 2½' in Motihari.

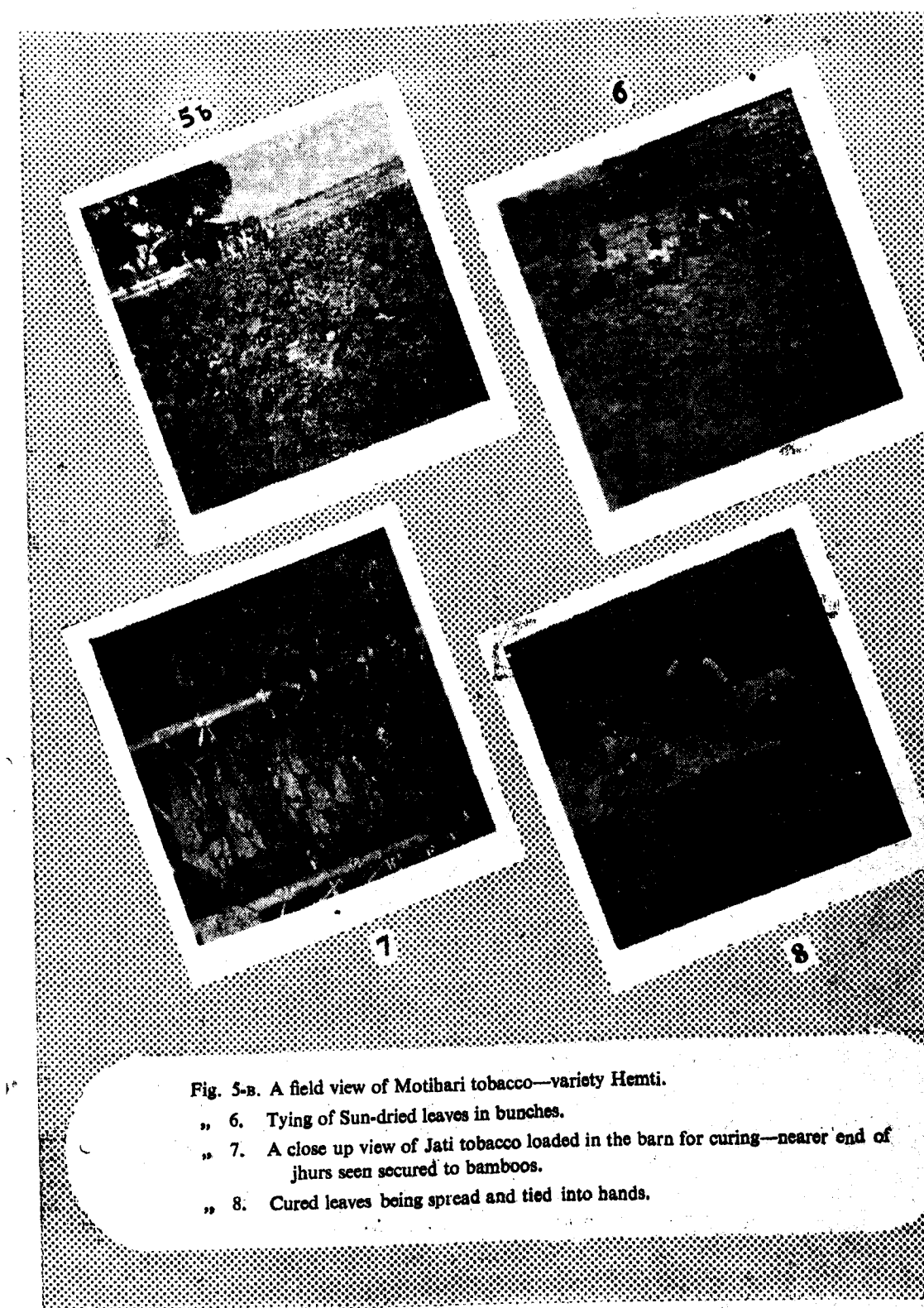
Cultivation of the Crop :

(a) *Inter-culturing* : Cultivation of the crop is commenced soon after the seedlings have been established. Interculturings at 4 to 5 days interval are done in crosswise and diagonal directions with hand drawn country ploughs till it is no longer possible to work without damaging the plants (Fig. 3). No bullock power is employed in the tobacco fields after transplanting.

(b) *Weeding and clod crushing* : This operation is carried out 2 to 3 weeks after transplanting. In this operation stirring of soil around the plant, removal of weeds and crushing of small clods by khurpi are done simultaneously. The field is then left undisturbed for about 7 to 10 days. Subsequently the interculturing operations are resumed. Depending upon the amount of weed growth 1 to 2 more weedings are given.

(c) *Topping and Suckering* : Jati plants are ready for topping about 7 to 8 weeks and Motihari plants about 5 to 6 weeks after planting. At the time of topping, sand leaves upto a height of 9" to 10" in jati and 6" in Motihari are first removed and after leaving the desired number of leaves on the plant the flower head is pinched off. The sand leaves thus removed are collected, strung on a thin bamboo strip and placed in a shed for curing. Mostly these are retained for family consumption and sold only if found in excess. Since such cured leaves known as *Bispath* usually do not fetch remunerative price some farmers leave them in the fields and do not collect them at all. Depending upon the vigour of the plant 7 to 9 and 5 to 8 leaves are retained per plant in Jati and Motihari varieties respectively. At the time of topping the soil around the plant in the Jati tract of Adabari is made compact by means of a wooden hand tool. Small suckers if found in the leaf axils are also removed while topping. Suckering is commenced about a week after topping and repeated 4 to 5 times at 7 to 10 days' intervals.

(d) *Irrigation* : The growing season of tobacco is almost rainless and hence at least one irrigation is required by the crop. The common



sources of water for irrigation are a nearby stream, pond, hand pump, etc. If the above sources are not available then a small Kacha well is dug at a suitable location and the water lifted by Dheki (Fig. 4). Several other devices for lifting irrigation water are also employed. The most common one is the use of "Dheki" or some modifications of it. Due to the lack of irrigation facilities, especially in jati growing tract, a dry crop of jati is also taken. Resourceful farmers, however, give one irrigation either from a hand pump installed temporarily in the field or by bringing water in earthen pots. In the latter case each plant is watered at the rate of one pot (about 2 gallons) each. In Motihari growing areas at least one irrigation is given. Rarely, a dry crop may also be taken. Irrigation water when drawn from a well or through a pumping set from the nearby stream, etc., is directed in small furrow-like channels along the slope. Along the course of such channels, small pits are made to collect water which is splashed in the vicinity with the help of broad shallow vessels.

Harvesting :

After topping, the leaves grow in size and become thick in body. As maturity approaches their green colour changes to light shades of brownish green. Brownish or yellowish brown spots then develop in the lamina tissue. This is considered to be the right time for the harvest of the concerned leaves. For motihari the time for first priming is about 85 days and for jati about 130 days after transplanting. (Figs. 5 a and 5 b.)

Harvesting is done by priming method in both the types of the tobacco. The number of primings varies from 1 to 3 depending upon the season, and whether the crop is irrigated or not. The priming is done on clear sunny days during morning hours by moving in the field and removing 2 to 3 matured leaves per plant at a time. The process is repeated at 3 to 5 days interval till the harvest is over. The matured leaves are primed by detaching the petiole from the stem with a special priming knife (Katari).

Curing :

The primed leaves are spread flat in the field with their back facing the sun. The leaves thus spread for sun-drying are tied into bunches of 3 to 5 leaves (Fig. 6) in the afternoon and

removed to the curing sheds in the evening. Thin and short (about 9" to 12") green bamboo strips known as tamaal are used for looping the leaf bunches. If the leaves are not sufficiently dried on the first day, the bunches are taken out in the sun for further drying next day and then finally loaded in the curing sheds. Thus the method of curing employed is strictly speaking a *sun-cum-air curing*. The curing sheds employed vary widely with regard to constructional details, sizes and materials used in construction. The most common are either completely G.I. sheet sheds, thatched structures, thatch walls with a G.I. sheet roof; and bamboo matting walls with G.I. sheet roof. The space available in residential houses, cattle sheds, etc., is also used if required for curing purposes.

The leaf bunches are hung on long thin bamboo strips about 4' to 6' long known as *jhur*. The two ends of the *jhur* are secured to the framework of the shed. The entire space available in the curing sheds underneath the roof, on side walls and in the middle of the shed is utilized for loading the leaf bunches (Fig. 7). The leaves are left undisturbed and allowed to dry completely. In about 4 to 5 weeks the leaves get ready for lowering. The leaves are considered ready for lowering when the mid-ribs get completely dry. Usually the unloading of the leaves is done either during nights or during early morning hours when they are in condition and fit for handling without damage. The *jhurs* are untied carefully and lowered with the leaf bunches on them. The leaf bunches are then pushed in towards the centre of the *jhur* from both ends and are tied together by looping and twisting the free ends of the splinter around them. These big bunches are bulked in heaps on the floor lined with paddy straw, gunny bags or other similar materials to prevent excessive dampness getting into the heap.

Bulking :

The bulk heaps are turned at about 2 weeks' interval. Few farmers dispose off their produce at this stage while others spread the leaves before sale. The leaves are spread one over the other, pressed, and made into a hand (peti) of convenient size by tying a tamaal around the cluster of petioles (Fig. 8). These hands are again put into bulk heaps and turned at about 3 weeks' intervals till the produce is finally disposed off. Usually grading of leaves is not done by the farmers, but they keep the lots

of sand leaves (Bispath) and main leaves separately.

Yield :

The yield per acre of jati tobacco leaf varies from 6 to 8 maunds and 8 to 10 maunds for the dry and irrigated crops respectively. The yield of motihari tobacco leaf varies from 9 to 12 maunds per acre.

Pests and Diseases :

Cut worms in the early stage and leaf eating caterpillars later on cause some damage to the crop. Incidence of Aphids (*sidduli*) was observed especially in late planted jati crop. Amongst the diseases mosaic (locally known as *Kodua*) especially in jati and stem-rot in motihari do considerable damage.

Tools and Implements :

The major tools and implements used by the farmers are plough, planker, khurpi and katari.

(a) *Plough (Langal)*: The plough consists of a single wooden piece serving as body and share both, a wooden beam and a bamboo handle. The share end is armed with a flat pointed iron piece 9" to 10" long fixed on it.

(b) *Planker (Moi)*: It is made of two straight, short nodded fully matured split bamboo halves about 8' long. These two halves are joined together back to back fixing five bamboo pegs about 1½' long at suitable intervals. This resembles a short ladder.

(c) *Khurpi (Pasun)*: This is a hand tool used for weeding, clod-crushing, transplanting and stirring the soil. It consists of rectangular iron blade to which a wooden handle is fixed.

(d) *Katari*: It is similar to sickle with a sharp cutting edge but smaller in size.

(e) *Rake (Hath Chini)*: It is used for collecting weeds, etc., and also for covering the furrows opened in between the rows during interculture; consists of a wooden head piece, bamboo pegs and a long bamboo handle.

(f) *Clod breaker (Ushti)*: It is used for breaking clod by manual labour; consists of a small wooden head piece to which a long bamboo handle is attached.

(g) *Thela Moi*: It is a miniature hand planer consisting of a small bamboo half (about

1½' long) to the back of which a long bamboo handle is fixed. It is used for covering the furrows opened in interculturing to conserve moisture.

Important Problems :

The locally grown jati and motihari varieties of tobacco have not been explored in the past in their various agronomical and botanical aspects. Although the standard of cultivation is fairly high and distinct varieties are grown in specific areas, yet determination of optimum cultural and manurial requirements and evolution of better strains should prove of immediate benefits to the grower. Systematic studies on these aspects have already been initiated at the Wrapper and Hookah Tobacco Research Station, Dinhata and work so far done has given some useful indications. For example, the growers always give a standard spacing of 27" to 30" both ways in motihari disregarding the fact that varieties differ considerably in the natural size of their plants and the habits of growth, and hence in their relative requirements of space.

In a complex experiment conducted at the Research Station for two years with one of the large sized motihari varieties (*Hemti*) it was found that spacing the plants closer gives significant increase in the yield without reducing the quality of the leaf. Determination of proper spacing for the individual varieties, therefore, is a promising line of investigation.

Again tobacco plant is highly sensitive to the environment—adaphic and atmospheric—in which it grows and the ultimate size and spread achieved by the plant is greatly influenced by these factors. Studies therefore need to be made to determine the optimum spacing of plants in relation to the time of planting, level of manuring and topping.

Tobacco growers in this region entirely divert their farmyard manure resources to feed their tobacco crops. Huge quantities of this manure are applied to tobacco and all other crops including jute and paddy go unmanured. This is certainly not a satisfactory practice and immediate studies are deemed necessary to cut down the F.Y.M. application to tobacco to the bare minimum and to work out suitable schedules for the optimum manuring of this crop. Such studies need to be supplemented by additional studies of the chemical and other properties of these soils.

Hookah and Chewing Tobaccos of North Bengal

The co-existence of two cash crops, viz., Jute (golden fibre) and tobacco (golden weed) as complementary partners in the established cropping pattern of the motihari growing areas needs to be thoroughly exploited by working out an integrated schedule of manuring for both the crops.

To the tobacco growers, by far the most important problem needing immediate solution is lack of suitable irrigation facilities. Considering all the relevant factors it seems that oil driven pumping sets are most suitable in these areas. In many places these sets can be fitted on the nearby streams while in farther away places deep-bore tube wells could prove useful.

The area under tobacco controlled by individual grower is rather very small ranging from less than a Bigha to about 2 to 3 acres (1 acre=3 bigha). Because of the smaller acreage under

tobacco to be looked after, the individual grower especially in Adabari tract, pays excessively more attention to the crop. It may be correct to say that to these growers, tobacco is a garden crop and its cultivation an art. Tobacco has become a part and parcel of their life and thus a life-time hobby.

Acknowledgment :

The authors wish to express their thanks to Dr. N. R. Bhat, Director, Tobacco Research, Central Tobacco Research Institute, Rajahmundry for his constant interest and encouragement. Thanks are also due to Shri U. K. Nath Roy, Superintendent of Agriculture, Cooch Behar and Shri B. K. Doshi, Assistant Collector, Central Excise and Land Customs, Cooch Behar for the assistance rendered during the course of the survey and for providing available statistical information respectively.

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(Experience of the Alma-Ata Tobacco State Farm)

The Alma-Ata State Tobacco Farm holds first place in the U.S.S.R. according to tobacco yields which are steadily increasing.

We have in mind its high average yield of 1.2 tons of tobacco per acre received from the farm's 1,150 acres under cultivation. This is not a chance success but the result of many years' hard work.

Our foremost workers attain even higher tobacco yields than the State farm's average harvests. Thus, in 1953 Hero of Socialist Labour T. Iriskina and her brigade harvested over 1.6 tons of tobacco from each of their 16.7 acres of land.

How is the steady increase in the State farm's tobacco yield to be explained?

varieties bred by Prof. M. F. Ternovsky, and a number of polar indications of the varieties being crossed), 19 combinations of different tobacco variety crossings were conducted at the State farm to produce a hybrid that would combine in the first generation commercially useful properties of both parents and possess a more powerful growth, more intensive development and higher vitality than its parents, i.e., possess that phenomenon that is called in science "heterosis."

These crossings gave us 2.1 kg. of hybrid seeds.

In 1946, seedlings were raised from these seeds and planted on experimental plots and on ordinary plantations, so as to test the hybrids' crop capacity.

A. Y. BRICKEL

Hero of Socialist Labour

It is rather difficult to achieve such results only by perfecting agrotechnical measures.

In our efforts to raise tobacco yields we applied I. V. Michurin, the great Russian biologist's teachings on hybridization, that contain unlimited possibilities for the guided transformation of the plant itself in the direction needed by man.

Inter-brand hybridization of tobacco was practically employed for improving yields for the first time in 1945.

On the basis of Michurin's principles pertaining to the matching of parent pairs (the geographic remoteness of origin of the species being crossed, the crossing of old varieties with new immune

Of the hybrids planted, particularly notable growth was attained by the Hungarian Garden × American 315 hybrid which later was given the name of Alma-Ata Hybrid by the State Commission on Variety Testing. This hybrid almost two-fold excels its parents in growth, leaf size and yield.

The hybrid's yield on the experimental plots exceeded 1.6 ton per acre, whereas that of the standard variety used in our region—the Trape-sond 1272—was less than 1.0 t.

In 1947 the State farm planted 62.5 acres with hybrids. In the same year A. Bondarenko and her brigade harvested 2 tons of hybrid

A. Y. Brickel

tobacco per acre, which was the highest yield in the U.S.S.R.

What is particularly valuable is that the hybrid is not inferior to standard varieties as to goods assortment and smoking qualities, which were repeatedly borne out by chemical analysis and tasting.

The tobacco hybrid's great vitality manifests itself in that the seeds' shoots appear 3-4 days earlier than those of standard varieties, that the seedlings show intensive growth and resistance to diseases (mealy dew and mosaic disease), that it is less affected by field transplantation, strikes root better and shoots up faster.

During field vegetation the hybrid overtakes standard tobacco varieties in growth, development and maturing.

The State farm on establishing the hybrids' advantages has been cultivating hybrid tobacco on all its land since 1950.

It is mainly the introduction of hybrids that ensured the steady growth of tobacco yields at the State farm. The State farm produced nearly one hundred tons of tobacco in excess of its plan in the past year alone.

It is important to note that while the State farm's total tobacco harvest sharply increased, there was practically no difference in the number of workers engaged in tobacco growing, this leading to a significant rise in labour productivity.

Continuing their work in matching new parent pairs the State farm staff had bred a number of new inter-variety tobacco hybrids, of which Alma-Ata Hybrid 2 and Alma-Ata Hybrid 1 are especially notable for high yields.

Tests of the hybrid conducted at collective farms have proved it high yields and the Ministry of Agriculture of the Kazakh SSR has since 1950 been recommending collective farms to cultivate hybrid tobacco.

The State farm supplies collective farms with hybrid seeds. It annually supplies them with hybrid seeds needed for sowing 875 acres and with hybrid seedlings for planting 500 acres.

The technique of artificial pollination for producing first generation hybrid seeds is not difficult and does not require a great deal of labour.

Due to the tobacco plant's high propagation rate, the seed crop from one plant provides the raising of seedlings for cultivating 2.5 acres of tobacco.

In order to get hybrid seeds of a parent pair that has already proved its value, we plant maternal and paternal plants in alternate rows on a seed plot removed from other tobacco plantations at a distance of 200 to 300 metres. Thus, when growing Alma-Ata Hybrid 3 seeds, we plant in the first row the paternal plants American-315, in the second the maternal brands Hungarian Garden, in the third again American-315 and so on. A day or two prior to flowering the maternal plants are castrated. To do this, the not-yet-opened flower is opened with the aid of pincers, and the unripened anthers are removed. The next day dust from the paternal plant anther is put on the castrated flower's pistil. If maternal plant flowers were castrated on time, the result will be hybrid seeds. With this planting method there is no need to cover the floscules with isolators.

To ensure the hybrid's high yield it is essential to employ such agrotechnique that would fully reveal its latent possibilities. Only the organic combination of purposeful selection and high-level agrotechnique produce good results.

There are a number of features in the agrotechnical methods employed at the State farm that differ from those of usual tobacco agrotechnique recommended for irrigation farming.

Many tobacco growers can't bring themselves to plant tobacco over an alfalfa stratum, fearing an excess of nitrogen which, in their opinion, lowers the quality of tobacco. Many years of practice have convinced us that tobacco grown over alfalfa is in no way inferior to that raised over any other predecessor (grain, tobacco, etc.) provided the soil is fertilized with superphosphate.

So, the tobacco is planted over alfalfa. In spring, when the grass reaches a height of 45 to 50 centimetres, we plough the alfalfa under with coulter ploughs. Thus the soil receives green (sideral) fertilizer.

To accelerate seedling growth we make extensive use of poultry dung, small doses of which are often (once every two-three days) introduced into the soil, as has been recommended by the All-Union Tobacco Institute.

APRIL—JUNE 1958

Poultry dung contains, besides nutritional substances, growth-promoting substances as well. The plants' growth and development are particularly enhanced by four waterings of the seedlings with a weak solution of poultry dung.

The seedling section of the farm is provided with special concrete pits for poultry dung preparation. One pail of dung is mixed with ten pails of water; then this is drawn for a period of two—three days and then filtered. One or two half-a-litre cans of this liquid are added to each sprinkler. Thus one pail of poultry dung is dissolved in 100 or 200 pails of water. One sprinkler waters 4 square metres.

Tobacco planting density is determined by its variety and soil characteristics. At our State farm we plant 175 thousand hybrids of our own selection per acre.

The ploughed field is furrowed from North to South, these furrows serving for watering. Then the seedlings are planted on the eastern crest's slope. This is done so as to have, in the first days, only morning sunrays falling upon the seedlings, and that at noon the seedlings be protected by the shade of the furrow crest, such arrangement greatly contribute to the seedlings taking root.

It has been proved that the period between the fiftieth and sixtieth days of field vegetation is critical for tobacco, as far as the moisture supply is concerned. This is why we water the plants every 2—3 days during this period. If the tobacco does not suffer any lack of water in this period, it begins to grow rapidly.

Of great significance, besides watering, is intertillage and top dressing with ammonium nitrate and phosphates.

We attach major importance to correct topping and "suckering" of tobacco plants. It is well known that topping alone without a subsequent "suckering" is not effective.

We conduct topping in three stages: First topping and simultaneous suckering during the flowering of one-third of the plants, second topping during the flowering of the second-third of the plants, and so on. When carrying out the second topping and suckering, we again sucker earlier topped plants; during the third topping, general suckering is again conducted. An additional suckering is conducted when superfluous side shoots appear.

At sections with more powerful plants an additional, deep, topping is conducted towards the end of flowering, so as to receive a more elastic and lighter leaf.

We start the first harvesting when the plants' first leaves have completely ripened.

Previously the State farm employed only two methods of tobacco curing, the sun and fire methods.

Since 1950 a special curing shed has been operating at the farm for shade curing. There are 17 such sheds at the farm now, that can accommodate one-third of the total tobacco yield.

Five years of practice have shown that the new method for tobacco curing results in improving the quality of tobacco, in eliminating mechanical damage to the leaf, and in the decrease of harvest losses. There is also a significant saving of labour and fuel.

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EFFECT OF VARIOUS RECENT INSECTICIDES ON THE SOIL-BORNE INSECT PESTS OF TOBACCO IN NURSERY*

INTRODUCTION

Tobacco is one of the important cash crops of Gujarat, and is extensively grown in the Charotar area lying between the rivers Mahi and Shedhi of Kaira district in Bombay State. High market prices give an incentive to the cultivators of this tract, not only to put more area under tobacco but to obtain higher yield and better quality by following various recommended methods. In spite of all these efforts to improve yield and quality, one of the greatest difficulties experienced by tobacco growers is in obtaining healthy and sturdy

seedlings goes down every time when it rains or when the beds are watered. In case of serious infestation very few seedlings are available for transplanting.

The important pests that cause severe damage to tobacco both in nursery and after transplanting are :—

1. Rove beetles—
(a) *Bledius gracilicornis* Kr.
(b) *Oxytelus latiusculus* Kr.
2. Dirty black long beetles (*Rhyssomus orientalis* Muls).

H. K. PATEL, R. C. PATEL AND R. M. PATEL

Institute of Agriculture, Anand, Bombay State.

seedlings of required size at the right time due to the serious mechanical damage caused by the incidence of various pests in the nursery.

Such insects are in a habit of hiding in the seed bed soil. They create characteristic burrows in the soil and remain in them. While burrowing in the soil, they excavate soil particles which cover tender seedlings. The damage becomes more serious with every watering as the excavated soil which was loose, settles hard on the tiny seedlings. Immediately after the water in the seed bed is absorbed, insects, which had come out, start to burrow themselves excavating new soil. This soil in turn buries more seedlings at the time of subsequent rain or watering. Thus the population of

3. Black beetles (*Onthophagus* Sp.)
4. Maggots of house fly (*Musca domestica* L.)
5. Small black crickets (*Tridactylus riparius* Ss.)
6. Mole crickets.
7. Tobacco stem borer.
(a) *Gnorimoschisma heliopa* L.
(b) *Gnorimoschisma opercullela* Z.
8. Cut worms.
(a) *Prodenia litura* L.
(b) *Agrotis ypsilon* Rott.

*The work was financed by the Indian Central Tobacco Committee.

9. Tobacco leaf eating caterpillar (*Heliothis assultagen*). (*Plusia ni* Hb.)
 10. Tobacco capsule borer (*Heliothis armigera* Hb.)
 11. Surface grass hopper (*Chrotogonus* Sp.)
- Of these, those which affect stand of seedlings due to burrowing habit are :—
1. Rove beetles—
 - (a) *Bledius gracilicornis* Kr.
 - (b) *Oxytelus latiusculus* Kr.
 2. Dirty black long beetles (*Rhyssalus orientalis* Muls).
 3. Black beetles (*Onthophagus* Sp.)
 4. Maggots of house fly (*Musca domestica* L.)
 5. Small black crickets (*Tridactylus riparius* Ss.)
 6. Mole crickets.

Review of Literature

Vast literature on pests of tobacco in nursery and transplanted fields has been published by various workers, and a number of references can be cited for the work on bionomics and control of *G. opercullela* Z., and *G. heliopa* L., etc., but very little information is available regarding the soil borne pests of tobacco in nursery. However few references covering the tobacco pests in general are reviewed here.

The important pests of tobacco reported by various workers are tenebrionids (*Gonocephalum simplex* F), wire worms (*Trachy notus* sp.), *P. heliopa* Low., *Heterodera radicola* Greeff., cutworms, crickets and grass hoppers (Jack 1927). Mc Carthy (1933) described nature of damage caused by *P. opercullela* Z., *Heliothis obsoleta*, cutworms and *Listroderes costirostris* Schonh (*Obliquus* Gyll.) and suggested control measures for *P. opercullela* Z. The work on the life history and control measures of Aphid, *Myzus persicae* Sulz., *P. holiopa* Low., *P. opercullela* Zell., *Lema bilineata* Gem., cutworms and Aleurodid (*Bemisia* Sp.) has been reported by Smith (1938). Froggatt (1941) while describing the nature of damage caused by Larvae of *Prodenia litura* F. and *plusia signata* F., *Psara hipponalis* Wlk., *P. heliopa* L., and cut worm (*cirphis unipunctata* Haw) suggested control measures for each of them. Experiments on insecticidal control measures were

conducted by Morgan (1949) on *Listroderes obliquus* Gyll, cut worms, *Plusia* Sp., *Heliothis armigera* (Hb.), *G. opercullela* Z. and *G. heliopa* L. He observed that DDT gave good results against *G. opercullela* Z.

According to Dominick (1950), dusting 10% Toxaphene or 10% DDT or 1% Dieldrin or 90% Cryolite is effective for the control of cutworms (*Protoparee sexta* Joh & *P. quinque-maculata* Haw.) in the field crop.

From the literature reviewed it is clear that due attention has not been paid on this aspect of nursery pests and their control, and that no suitable remedial measures for the severe damage caused by these pests especially in early stages of seedlings in the nursery beds are yet in the hands of cultivators. Work on this problem was therefore taken up with a view to evolve suitable remedial measures for recommendation to the cultivators.

Material and Methods

To find out suitable method of control of these insects an experiment was conducted during the year 1954-55 with the following treatments :—

	PER CENT
1. Dieldrin water suspension spray ...	0.05
2. Aldrin water suspension spray ...	0.05
3. DDT water suspension spray ...	0.2
4. Folidol emulsion spray ...	0.03
5. Control (water only) ...	...

The insecticides were sprayed in the form of suspension of emulsion on the surface of the bed by a watering can at the rate of 2½ gallons per bed of 12' × 4'. The treatments were given only once, after sowing of the seeds and before the seeds began to germinate. The treatments were replicated four times.

Results

To estimate the number of insect burrows per bed, counts of the number of burrows in one square foot are a each at four different places, at random, were taken in each bed. The data obtained are summarised in the Table I.

TABLE 1

* Mean number of insect burrows per square foot area of the bed before and after treatment

Treatment	Before the treatment	Mean number of insect burrows per square feet after the treatment								
		1st day	2nd day	3rd day	4th day	5th day	6th day	7th day	8th day	15th day
Aldrin	...	39.8	0.19	0.00	0.00	0.06	0.25	0.44	0.06	0.00
Dieldrin	...	39.4	0.06	0.00	0.00	0.00	0.19	0.06	0.19	0.00
DDT	...	44.2	2.37	0.31	0.75	1.50	1.20	1.70	1.70	1.75
Folidol	...	43.4	0.13	0.00	0.56	1.70	2.19	3.06	2.56	4.44
Control	...	37.8	37.44	34.63	32.10	28.56	23.75	18.75	16.88	15.94

* Mean of 4 replications

The percentage control obtained by different insecticides as calculated from the data given above is shown in Table 2.

TABLE 2

Percentage control obtained by different insecticides

Treatment	1st day	2nd day	3rd day	4th day	5th day	6th day	7th day	8th day	15th day
Aldrin	...	99.52	100.00	100.00	99.79	99.00	97.77	99.64	100.00
Dieldrin	...	99.84	100.00	100.00	100.00	99.24	99.68	98.93	100.00
DDT	...	94.59	99.24	98.00	95.52	95.68	92.25	91.39	90.62
Folidol	...	99.70	100.00	98.48	94.82	91.97	85.81	86.81	75.78

Examination of the data shows that 98 to 100% control was obtained by all the insecticides tried, viz., Dieldrin, Aldrin, DDT and Folidol and remained effective to that level for three days after the treatment. Dieldrin and Aldrin remained effective for a longer duration as compared to DDT and Folidol. Aldrin and Dieldrin controlled the insects to the extent of 99 to 100 % even after one week, where as, it was 76 and 91% for Lolidol and DDT respectively. The effectiveness of the insecticides, judged for a period of 15 days was however of the following order :—

Dieldrin, Aldrin, DDT and Folidol. Folidol not only is dangerous when used by unskilled workers, it has no residual property also.

The same experiment was conducted during the year 1955-56, with Endrin as an additional insecticide. Endrin was used as 0.01% water emulsion spray, while rest were used at the same concentration as used in the previous year. The observations were taken in the same manner as were recorded in the previous year. The data obtained are summarised in Table 3.

TABLE 3

* Mean number of insect burrows per square foot area of the bed before and after treatment

Treatment	Before the treatment	Mean number of insect burrows per square feet after the treatment								
		1st day	2nd day	3rd day	4th day	5th day	6th day	7th day	8th day	15th day
Aldrin	...	41.44	0.12	0.50	0.25	0.44	0.69	0.25	0.38	0.50
Dieldrin	...	43.06	1.56	0.50	0.25	0.06	0.88	0.19	0.38	0.62
DDT	...	37.06	5.31	7.25	4.62	4.44	3.75	2.00	1.88	2.06
Folidol	...	49.38	0.75	2.12	3.75	2.56	2.50	1.81	1.94	2.38
Endrin	...	32.31	1.56	2.06	1.62	0.81	2.06	0.75	1.31	1.38
Control	...	35.37	15.64	16.62	13.44	13.75	7.56	3.19	6.25	3.62

* Mean of 5 replications

The percentage control obtained by different insecticides as calculated from the data given above is given in Table 4.

TABLE 4

Percentage control obtained by different insecticides

Treatment			1st day	2nd day	3rd day	4th day	5th day	6th day	7th day	8th day	15th day
Aldrin	...	...	99.71	98.79	99.40	98.94	98.33	99.40	99.08	98.79	100.00
Dieldrin	...	...	96.38	98.84	99.42	99.86	97.96	99.56	99.12	98.56	100.00
DDT	...	...	85.67	80.44	87.53	88.02	89.88	94.60	94.44	94.44	100.00
Folidol	...	...	98.48	95.71	92.31	94.82	94.94	96.33	96.07	95.18	100.00
Endrin	...	...	95.17	93.62	94.99	97.49	93.62	97.68	95.95	95.73	100.00

Trend similar to the previous year was observed this year. All the insecticides remained effective throughout the period of study. However the percentage control, in case of Dieldrin and Aldrin is appreciably higher than the rest, and hence they are preferred to DDT, Folidol and Endrin for the control of soil-borne pests in tobacco nursery.

Summary

Investigations were carried out to find out suitable insecticides to control the soil borne

insect pests of tobacco in nursery.

The insecticides tried were Aldrin 0.05%, Dieldrin 0.05%, Folidon 0.03%, Endrin 0.01% and DDT 0.2% and all of them were effective in controlling these pests. There was very little difference in the effect of Aldrin and Dieldrin and that of Folidol and Endrin. DDT was as good as Folidol and Endrin when protection for a period longer than one week is necessary. It is also likely that Endrin may give better results than the remaining insecticides if used at a strength of 0.05%.

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USE OF KRILIUM AS A SOIL CONDITIONER IN FLUE-CURED TOBACCO NURSERIES

Introduction :

The raising of tobacco nurseries in the deep black clayey soils (50 to 80% clay) of Andhra Pradesh is not always a success. The soils are heavy clays, poor in structure and organic matter content and with high water-holding capacity. Moreover, the seedlings in the nursery are subject to heavy damping off caused by *Pythium aphanidermatum* probably due to the poor crumb structure and high moisture content of the soil.

Studies with a number of chemicals which aid in promoting soil aggregation have shown

Materials and methods

The results reported here are from two trials conducted at the Central Tobacco Research Institute, Rajahmundry. In the preparation of nursery beds, river sand at the rate of 50 tons per acre was used and was worked up with the top 4" of the soil. Farmyard manure, wherever it was used, at the rate of 10 tons per acre was spread uniformly on the top of the nursery bed and was well mixed with the top 3" of the soil, 'Kriliium' was applied to the top 1½" of the nursery soil and was well mixed.

The first experiment was on the effect of

K. G. TEJWANI¹ AND K. V. VENKATARAMAN²

that some synthetic polyelectrolytes are very useful in improving the soil structure (Allison 1952; Hedrick and Mowry 1952) and also in increasing the growth and yield of crops (Martin *et al* 1951). Since then quite a large number of workers have tested the effect of these soil conditioners on the soil structure and also on the germination, growth, and yield of a number of crops. Tamhane and Chibber (1954) reviewed at length the effect of synthetic soil conditioners on soil structure with special reference to a number of Indian soils. The present studies were conducted at the Central Tobacco Research Institute, Rajahmundry, to investigate the possibilities of using 'Kriliium' the sodium salt of hydrolysed polyacrylonitrile, in the tobacco nurseries to promote better growth of seedlings and reduce incidence of disease.

different doses of 'Kriliium' with and without farmyard manure as basal dose, on the physical properties of the soil and on the growth of seedlings. Three doses of *Kriliium* at concentrations of 0.025%, 0.05% and 0.10% by weight of soil (i.e., 125, 250 and 500 lbs. per acre for top 1½" soil depth) were tried. The experiment was a split plot design with no farmyard manure and farmyard manure as main treatments and the different doses of *Kriliium* as sub-treatments, and was provided with ten replications. Germination was good except in four beds. "Damping off" was effectively controlled by spraying with *Perenox*, a copper fungicide.

In the second experiment the effect of *Kriliium* on disease incidence was tested. The experiment was a split plot design with no spray and *Perenox*, spray as main treatments. The

¹ Soil Conservation officer, Baroda. Formerly Pedologist, Central Tobacco Research Institute, Rajahmundry.

² Pedological Assistant, Central Tobacco Research Institute, Rajahmundry.

experiment was provided with seven replications. The germination was good in all the beds. Incidence of "damping off" was however, considerable in the unsprayed beds.

Results and discussion

The results of the first experiment are summarised in table I.

TABLE I

Treatments	Total number of seedlings	Number of transplants	Green weight of total seedlings in grams
<i>Main treatments—</i>			
No Farmyard Manure ...	321	87	1,120
Farmyard Manure ...	488	205	1,769
<i>Sub-treatments—</i>			
No Krilium ...	355	145	1,362
0.025% Krilium ...	404	159	1,522
0.05% Krilium ...	406	141	1,434
0.10% Krilium ...	451	140	1,459
S.E. % for main plots ...	26.03	30.70	23.30
C.D. (5%) for main plots ...	53.22	22.72	170.1
S.E. % for sub-plots ...	31.41	45.69	25.11
C.D. (5%) for sub-plots ...	N.S.	N.S.	N.S.

N.S. = Not significant

It will be observed that the application of farmyard manure significantly increased the total number of seedlings, their weight and the number of transplants, the effect being more marked in the latter. This is in conformity with the findings of the various other experiments conducted at the Institute. *Krilium* treatment did not have any effect on the stand and growth of seedlings in the nursery.

The effects of application of *Krilium* on the

physical properties of the soil were also studied. Soil samples for these studies were collected from the top 1½" of the nursery beds at the end of the nursery season i.e., 10 weeks after application. Samples were collected from five out of the ten replications selected at random, and were analysed separately for water holding capacity, percentage pore space, volume expansion, apparent density and specific gravity. The results are summarised in table II.

TABLE II

(Results expressed on oven dry basis)

Treatments	Percentage water holding capacity	Percentage pore space	Percentage volume expansion	Apparent density	Specific gravity
(Mean of 20 observations)					
<i>Main treatments :</i>					
No Farmyard Manure ...	46.81	51.98	29.62	1.55	2.47
Farmyard Manure ...	45.87	51.40	29.14	1.54	2.45
(Mean of 10 observations)					
<i>Sub-treatments :</i>					
No Krilium ...	47.24	52.61	30.21	1.56	2.50
0.025% Krilium ...	46.85	51.98	28.93	1.56	2.49
0.05% Krilium ...	43.91	50.39	28.62	1.55	2.39
0.01% Krilium ...	47.35	51.84	29.73	1.54	2.46

The above data indicate that none of the physical properties of the soil studied were appreciably altered by any of these treatments. As was pointed out earlier, the effect of *Krilium* on soil properties has been studied extensively both in the laboratory as well as in the field. Someworkers (Nishikata, *et al.*, 1953, and Vallance & Leverington, 1953) have reported that the effect of *Krilium* was more marked on alluvial or silt loam soil than on heavy clay or clay loam soil; on the other hand others have observed (Moss, *et al.*, 1954, and Kapur & Nair, 1954) that the effect of *Krilium* was more pronounced on soil with high clay content rather than on sandy or loamy soils.

Faulkner and Holmes (1954) and Smith

(1955) have however reported that *Krilium* had little effect on growth of seedlings in heavy soils and growth rate of maize respectively. The data reported above also indicate that *Krilium* had very little effect on the germination and growth of tobacco seedlings in the nursery.

In the second experiment, the effect of *Krilium* on preventing or reducing the incidence of damping off disease in the nursery was tested on the assumption that *Krilium* by improving the physical properties of the heavy black soil may improve the drainage and soil aeration conditions and consequently prevent or reduce the incidence of damping off disease. The results are summarised in table III.

TABLE III

Main treatments	Sub-treatments					
	No Krilium			Krilium		
	Total number of seedlings	Number of transplants	Green weight of total seedlings	Total number of seedlings	Number of transplants	Green weight of total seedlings
			GMS.			GMS.
No spray ...	104	25	321	174	56	591
Spraying with 'Perenox' ...	348	88	1,171	380	77	1,049
Mean ...	226	57	746	277	67	820
S.E. % main plots ...	59.5	38.5	45.9			
C.D. for main plots (5%) ...	138.4	21.9	332.3			
S.E. % for sub-plots ...	25.2	27.3	19.2			
C.D. for sub-plots (5%) ...	N.S.	N.S.	N.S.			

N.S. = Not significant

It will be observed that while spraying with 'Perenox' effectively controlled 'damping off', gave larger number of transplants, and consequently produced more green matter, *Krilium* was not effective in reducing the incidence of 'damping off'. This might be probably because *Krilium* had little effect in altering the physical properties of the soil.

Summary

Results of two experiments on the effect of application of *Krilium* at various concentrations on the physical properties of the soil, growth of tobacco seedlings and incidence of 'damping off' in the flue-cured tobacco nurseries are discussed.

Krilium had little effect in promoting better growth and reducing disease incidence in the nursery. It did not appreciably alter the physical properties of the soil studied, when samples were analysed at the end of the nursery season (10 weeks after application).

Acknowledgements

The authors wish to express their sincere thanks to Dr. N. R. Bhat, Director, Tobacco Research for his keen interest in the work and for providing the necessary facilities for the work. They also acknowledge with thanks the assistance rendered by Shri R. D. P. Mohana Rao, Field Assistant.

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RESEARCH IMPROVEMENTS WHICH GAVE A RECORD CROP

BY

Director, Central Tobacco Research Institute, Rajahmundry

The Central Tobacco Research Institute has set itself on a quest for quality in flue-cured tobacco and is reaping rich harvests by adopting newly evolved cultural improvements, viz., deep cultivation in summer, deep placement of fertilisers and paddy straw mulching. Incorporating composted tobacco stalks was an additional feature of the 1958 season. The result was a plot (see photograph) which was the envy of growers and an attraction to buyers. The cured leaf yield was as high as 1,542 lbs. and bright grade leaf 1,023 lbs. (66 per cent.) per acre and, happily, the leaf quality as reflected in size, texture and body went hand in hand with the enhancement in yield. The new idea of applying tobacco stalk compost increased the leaf size to as much as 32" x 22" and made the colour more flashy. No wonder, therefore, the plot was adjudged the best in crop competition in the East Godavari district. It may well prove to be the best in Andhra Pradesh.

Farmers can also raise similar plots. Deep cultivation in summer months can be done either with a tractor if one becomes available or by hand digging. For deep application of fertiliser, a simple bullock drawn implement has been fabricated at the Institute. It should soon be possible for a farmer to own an implement for his use. Tobacco stalks can be easily composted before monsoon after crushing under a roller or a cart and the compost spread in the fields in the month of July, i.e., three months before planting. Mulching can be done with either paddy straw or any other cheap stuff like twigs or grass after the first interculturing, about three weeks after planting.

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LOW SEED RATE AND SHADING OF SEED BEDS ARE BENEFICIAL TO TOBACCO NURSERIES IN BIHAR

Considerable loss of seedlings occurs in tobacco nurseries in Bihar due to beating rains and 'damping off' disease. It is observed that the 'damping off' disease occurs and spreads if there is a shower of rain immediately after hot sunshine and more so if the seedlings are overcrowded, due to high seed rate. It is also commonly noticed that the cultivators in Bihar use very high seed rates even as high as 1 to 2 ozs. per 200 sq. ft. of tobacco nursery for transplanting one acre of the crop.

The experiments conducted at the Hookah and Chewing Tobacco Research Station, Pusa, have shown that the optimum seed rate is only about 4 lbs. per acre or 1/3 oz. per 200 sq.ft. of nursery required to be raised for planting one acre of the crop with a spacing of 3' x 2' including gap filling. If the seed rate is higher than this, the seedlings suffer from overcrowding as well as from 'damping off' disease which thrives in overcrowded beds.

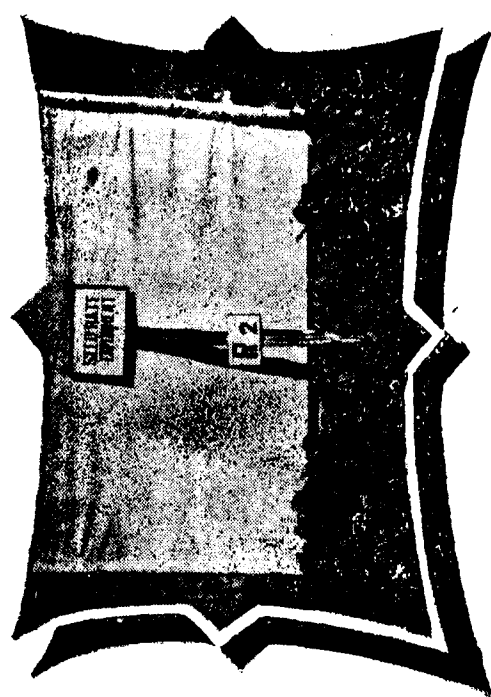
In order to prevent or at least minimise the damage to young seedlings from beating rains and 'damping off,' the nursery beds should be shaded. Shading may be done with 'tatties' made of thatch grass and split bamboos. The shades should be removed every morning for 2 to 3 hours, if there is no rainfall, to expose the young seedlings to sunshine. Shading should be continued till the seedlings are about 2 weeks old and therefore strong enough to withstand the beating rains.



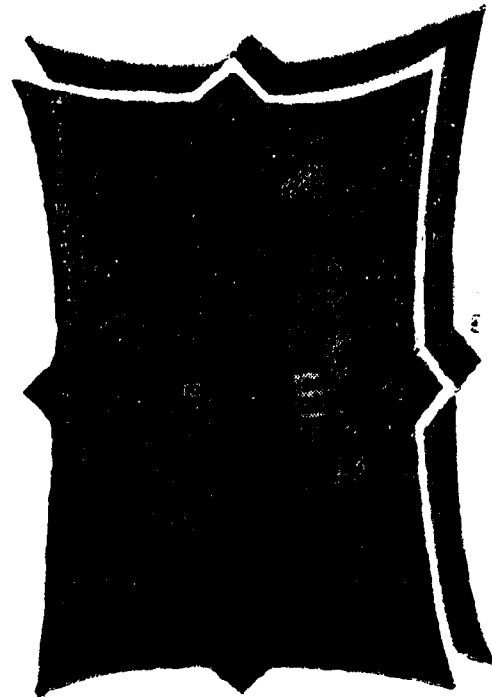
Seedlings from nurseries shaded with thatched grass tatties.



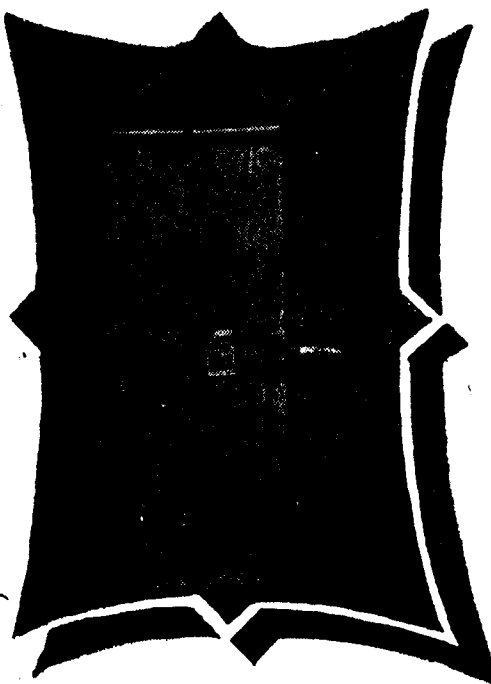
Seedlings from unshaded nurseries.



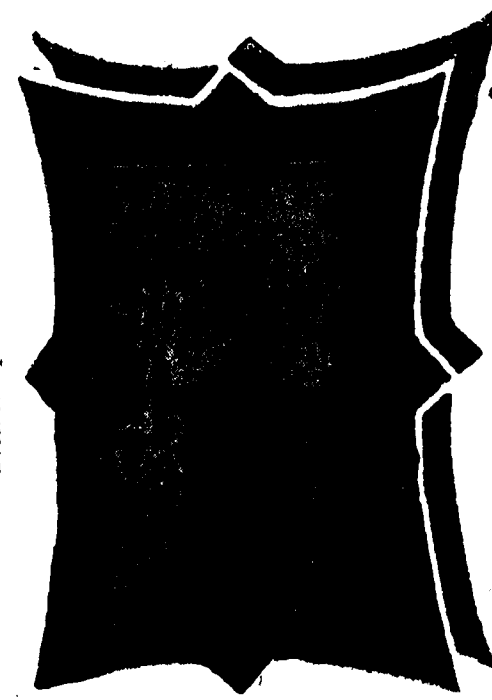
6 lbs. seed rate per acre in nursery.



Note the poor stand of seedlings in 2 lbs. seed rate.



2 lbs. seed rate per acre in nursery.



4 lbs. seed rate per acre in nursery.

Low seed rate and Shading of seed beds

In the experiments conducted at the Hookah & Chewing Tobacco Research Station, Pusa, as many as about 70 per cent. more transplantable seedlings were obtained from shaded beds than from unshaded ones. Further, it has been definitely proved over three seasons that, though these transplants look a little lanky, they come up well and give as good yield as those from unshaded nursery.

A shade measuring $4\frac{1}{2}' \times 7'$ costs about Rs. 1.62 nP. and eight shades costing only about Rs. 13.00 are required to cover 200 sq.ft. of nursery area to obtain seedlings for transplanting one acre. But, since the cultivator usually has on his farm all the material needed for the shades he will not have to spend much on this account from his pocket.

The shading of nursery and adoption of a seed rate of 4 lbs. per acre of nursery area will give the farmer a sufficiently large number of transplants and, as such, both these improvements deserve to be adopted by all the tobacco growers in Bihar.

The following hints will prove useful in the preparation of beds and sowing: Raised seed beds of 4 feet width and any convenient length should be prepared at about the end of July by leaving $1'$ to $1\frac{1}{2}'$ channels in between the beds for drainage of excess rain water. The seed should be evenly sown after mixing with fine sand or moist earth at the above mentioned rate.

SPACING AND TOPPING SUITABLE FOR DESI TOBACCO (*N. Tabacum*) IN NORTH BIHAR

The tobacco cultivators in North Bihar usually grow Desi tobacco with a spacing of $3' \times 5'$ and top the plants at 8-10 leaves. In order to judge whether the cultivators were following the correct practices, experiments were conducted at the Hookah & Chewing Tobacco Research Station, Pusa comparing the spacing and topping levels as adopted by the farmers along with others thought worth trying over a number of years. The results obtained show that the yield can be considerably increased without affecting the quality by adopting a closer spacing of $3' \times 2'$ and topping the tobacco plants at 14 leaves. The combination of this spacing and topping level gave an average of 1,581 lbs. cured leaf yield per acre as against 782 lbs. per acre obtained by $3' \times 3'$ spacing and 8 leaf topping.

Thus, more than double the yield was obtained by adopting closer spacing and higher topping.

Closer spacing of $3' \times 2'$ and higher topping at 14 leaves was also tried in cultivators' fields at five centres each round about Pusa and Bhagwanpur in North Bihar for two years and it was found that not only the total yield but even the yield of first grade leaf increased considerably i.e., by over 25 per cent by adopting the improved methods.

The cultivators round about Pusa and Bhagwanpur in whose fields these trials were conducted very much impressed with the results they obtained from the improved methods of closer spacing and higher topping and have begun following them. Other tobacco cultivators in North Bihar can do likewise and reap richer harvests.

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SEMINAR ON "OROBANCHE— CONCEPT OF ITS INCIDENCE"

A seminar was held on 6th December, 1957 on 'Orobanche-concept of its incidence.' Dr. N. R. Bhat, Director, Tobacco Research, presided. The Chairman and staff of the Agricultural Marketing Committee, the Officers of the Agricultural and Tobacco Extension Department and those of Indian Leaf Tobacco Development Company attended the meeting.

Mr. D. I. Mathrani, Plant Pathologist, Central Tobacco Research Institute initiated the topic by presenting a few preliminary results he had obtained in inducing germination of Orobanche seed with vitamin P.P. (nicotinamide) and distilled water on filter paper placed on sand. From his data he drew the following indications :—

1. Orobanche seed was capable of germinating in vitamin P.P. and even in distilled water when placed on wet filter paper over ordinary sand.

2. at 72°F the germination was upto 4.5 per cent and reached the maximum within a week.

3. germination in distilled water was upto 52.5 per cent when placed at 45°F for 48 days and later on transferred to 72°F. In vitamin P.P. the percentage was 62.4

when kept at 45°F. for 54 days and then transferred to 72°F.

4. the seed germinated to the extent of 39 per cent and 62 per cent respectively with distilled water and vitamin P.P. when the seeds were placed for 54 days at 45°F.

5. only seed of 1955-56 and 1956-57 seasons germinated while seeds collected in earlier years did not germinate.

Thus, he said, it appeared that

1. the orobanche seed was capable of germinating in soil without any host and that temperature and moisture were the more important factors for germination.

2. pulling out of shoots, rotation with a non host crop or leaving the field fallow for 2 years should reduce orobanche incidence on tobacco provided there is no infestation.

In the discussion that followed several doubts were clarified by the speaker.

Dr. N. R. Bhat in his concluding remarks expressed that the experiments so far conducted by the Pathologist, though preliminary had yielded very interesting results. He hoped that with more elaborate tests in future it may be possible to know more about this destructive parasite of tobacco. With a vote of thanks the meeting concluded.

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PROGRAMME OF AGRICULTURAL OPERATIONS FOR THE QUARTER

JULY—SEPTEMBER

FOR FLUE-CURED TOBACCO

Received from

Central Tobacco Research Institute

Rajahmundry

Nursery.—During this quarter the nursery area is selected, prepared and sown.

The area selected for the nursery should be of a high level with gentle slope. The soil should be light and porous to permit good drainage. Since during the quarter it is likely that about 25 to 30 inches rainfall will be received and as the heavy rainfall coupled with the warmth will enhance the occurrence of "damping off", the worst disease of the seed-beds, every effort should be made to drain off all the rain water as early as possible and prevent the beds from getting water-logged. It is highly essential

that the following points are observed in the selection of site for seed-beds :—

(1) The soil should be light preferably sandy loam with good drainage facilities. In case nurseries are to be raised on heavy black soils, to improve the structure of the soil it is advisable to apply about 50 tons of sand per acre and incorporate it with the top layer by ploughing. (2) Select sites with a gentle slope to facilitate quick drainage. (3) The site selected should be near a good source of water supply since regular and adequate watering of seed-beds in the early part of the growth of the seedling is highly essential. (4) The nursery site should not generally be located in the open windy plains as normally one or two cyclonic storms are received during the nursery season. If by force nurseries are to be raised in the plains it is better to provide temporary windbrakes either with Hibiscus or Sesbania.

Preparation of seed-beds.—With the commencement of the monsoon rains, the site selected for the nursery should be given frequent ploughings to remove the weeds etc., and to give a fine tilth. Bed formation is to be taken up in the beginning of August. The length of the beds may be of convenient size along the slope, if any. The width of the bed should be 3½ feet. Between two rows of beds, space of 1½' is to be left to serve as drainage channel during rains, and

APRIL—JUNE 1958

convenient space during watering and weeding. The beds should preferably be raised 4 to 6 inches high from the ground level to facilitate drainage. After the beds are formed the surface of the bed is to be brought into fine tilth removing all the stones and clods. Unless the top surface is in fine tilth at the time of sowing the tobacco seed which is tiny may go deep and may not germinate.

Basal Manuring :—After the beds are brought into fine tilth, manuring should be taken up. Groundnut cake and F.Y.M. are very good basal manures for tobacco nurseries. For supply of nitrogen, apply groundnut cake at the rate of 1,200 lbs. per acre. In case groundnut cake is applied, it should be applied in a powdered form two or three weeks before sowing mixed well with the soil. This will make it readily available to the young seedlings. The quantity to be applied is about 8 ozs. for every length of 5 feet. F.Y.M. should be applied at the rate of 80 C.L. per acre prior to sowing and preferably after powdering and sieving. The F.Y.M. should be treated with Bordeaux mixture or Perenox to prevent it from being a source of 'damping off'. It has been found to give large number of healthy and vigorous transplants if it is applied as 1 inch layer on top of the nursery beds.

Preventive dose :—Two or three days before sowing, spray Perenox (2 in 10) or Bordeaux mixture (2-2-50) as a preventive dose against 'damping off'. The usual rate of spray is about a gallon for 10 square yards.

After the spraying the surface of the bed is to be gently raked to bring them back to fine tilth, taking care to see that the lower layers of unsterilized soil are not disturbed and brought to surface.

Seeding :—The normal seed rate should be about $3\frac{1}{2}$ lbs. per acre or $1\frac{1}{4}$ tolas per cent. Heavier seed rate will result in thick stand giving scope for the spread of diseases and pests or producing thin lanky seedlings. Mix the seed with fine sand to make up to a large quantity and to ensure even distribution of seed over the beds.

After sowing, stir the surface very gently with tips of the fingers and then roll a cement pipe $3\frac{1}{2}' \times 1'$ twice to press the seed against the soil and to even out the surface.

The farmers are advised to use always pure certified seed. Pure seed processed, packed in the same way as was done in previous years,

produced at the Central Tobacco Research Institute, is available for sale.

Pure seed will save the growers from undesirable mixtures which will include bad quality leaf in their harvest.

It is not desirable to sow the entire nursery area at one time, since all the seedlings will come to planting at the same time. To ensure uniform supply of seedlings throughout the planting period, it will be essential to sow the beds in stages from the middle of August to the first week of September.

Watering :—Within 5 to 7 days from the date of sowing the seeds germinate; watering is one of the most important operations in raising a successful nursery. The beds should be watered from the time of sowing, care being taken to see that the beds are kept moist and not wet. Rose cans with fine holes are preferable for watering the nursery as pot with watering is likely to displace and collect the germinating seeds in patches. Excess watering is also harmful as very damp beds promote 'damping off'. In sandy soils where surface dessication is too much, it can be prevented by spreading paddy straw as a thin layer on the beds or casuarina twigs immediately after sowing. The paddy straw is to be removed immediately after germination and cover provided with cholan straw over the beds while casuarina twigs may be removed after about three weeks.

Weeding of the beds is to be attended to as and when found necessary. Before weeding it is better the labourers wash their hands with soap and water with a view to prevent them from passing on the mosaic disease.

Top-dressing about the fifth week after sowing :—In case due to some reason or other the growth of the seedlings is retarded, to force growth, apply ammonium sulphate at the rate of $1\frac{1}{2}$ tola per square yard in half the quantity of water required for one watering followed by the remaining half quantity to wash off sulphate of ammonia from the leaves. Application of ammonium sulphate should be followed by copious watering.

In spite of careful handling and management of seed-beds diseases and pests are bound to occur. The following remedial measures should be followed for some of the more important diseases and pests.

Control of damping off :—Cultivators should remember that they are to prevent 'damping off' from appearing rather than think of taking remedial measures after the disease has appeared. If the weather is clear, spraying may be done once in 5 to 7 days from the time the germination is complete up to about a month. Spraying (2 in 10) perenox or fytolan, or (2-2-50) Bordeaux mixture at the rate of a gallon for 10 square yards may be undertaken. Under prolonged or recurring wet conditions the application should be repeated frequently, preferably once in every third or fourth day. The object in such sprayings is to maintain some quantity of the fungicide in the soil so that 'damping off' will not set in.

Cutworms and Caterpillars :—As soon as any tiny caterpillar is seen in the seed-bed the growers should spray with rose can DDT 50 per cent W.P. Five tolas of DDT in one kerosene tin of water should be enough for 30 square yards of nursery. Second spraying may not be necessary.

Sanitation :—The nursery area and the surroundings should be kept as tidy as possible. Smoking or chewing of tobacco by the labourers while at work should be prohi-

bited. The workers should wash their hands with soap before entering for work. Diseased seedlings removed from seed-beds should be collected in some containers having a little fungicide and deported to a far off place. They should under no circumstances be thrown in the nursery areas. Detailed particulars regarding seed-bed management, application of fungicides etc., can always be had from the Central Tobacco Research Institute, Rajahmundry.

Main Field :—The tobacco field should receive bulk organic manures like F.Y.M. or compost. They should be carted in time to the fields. To a field of average fertility about 6 to 8 C.L. of F.Y.M. or 8 to 10 C.L. of compost per acre are sufficient. Before the onset of heavy rains, the F.Y.M. or compost is spread over in the fields and incorporated with the 1st and 2nd ploughings.

Since during the quarter the rainfall will be heavy the fields are to be ploughed as and when they are in condition with a view to conserve as much moisture as possible and to keep the fields free from weeds. If the fields are too weedy, periodical hand weeding should be resorted to.

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FOR CIGARETTE TOBACCO

Received from
Cigarette Tobacco Research
Sub-station Guntur

By the month of July, a few rains of South-West Monsoon would have been received and consequently the field operations commenced.

Groundnut which is the first crop in the two-year rotation (Groundnut-Sorghum-Fallow-Tobacco) practised in the locality is sown now. The field is harrowed once or twice with a three-tined harrow ("gorru"). Normally the crop is not manured; but in a few cases few cartloads of farmyard manure may be applied. In addition, fertiliser mixtures in varying quantities may also be given. It is better that the crop is sown as early as possible with the receipt of rains. The crop will be on the field till about the end of September.

Preparatory Cultivation:—Some fields are kept fallow for raising tobacco. The fields are ploughed at frequent intervals whenever circumstances and soil conditions are suitable for the operation. Generally by the end of the quarter, six or even more ploughings would have been given. Normally it would be so programmed that all ploughings are completed by September so as to permit the planting of tobacco as early as possible in October. Trials conducted at the Cigarette Tobacco Research Sub-station, Guntur have however shown that it would not be advantageous to plough the land more than 3 or 4 times, as more number of ploughings decrease the yield of tobacco (Cigarette tobacco).

Manuring:—The crop is manured in different ways. Organic manures either alone or in combination with fertilisers are applied. The organic manure given is generally the farmyard manure applied at the rate of 3 to even 30 cartloads per acre depending upon the nature of the fields and the availability of the manure. Groundnut cake at the rate of 100 to 300 lbs. per acre also is given in some instances. The use of groundnut cake, however, is going out of practice in recent times. The above manures are applied to the fields and ploughed into the soil at any time from the onset of rains (in June to July) to about the month of September. It may be noted here that it would be proper and advantageous to apply these manures as early as possible in the season so that there would be sufficient time for the disintegration of the manures as otherwise the tobacco crop is likely to produce leaf of inferior quality. The practice of keeping the farmyard manure in heaps on the field itself even from the summer months, pending the spreading and ploughing of the same later on in June to July or thereafter, is not a healthy one, as Nitrogen and other constituents of the manure are likely to be wasted. To avoid this wastage the manure should be carted freshly from the manure-pit direct and applied to the fields. The quantity of farmyard manure to be applied should depend on the nature of the field. If it is known that the field gives a darkish crop it would be a good policy to apply the manure at reduced rates. The manure may be applied every year if the tobacco crop does not show darkened leaf; otherwise, application of the manures in alternate years may be adopted. A fertile field should always be manured less and vice versa.

Green manuring the tobacco crop by greengram raised in June-August is also occasionally met with. Normally the use of a laguminous crop like the greengram may add more nitrogen to the soil than the optimal requirement of the tobacco crop. And therefore this practice may have to be observed with caution. Fertilising the green-

For Cigarette Tobacco

gram crop with heavy doses of phosphoric acid and potash might be beneficial to some extent.

Application of fertilisers to the tobacco crop is widely practised, the quantity applied per acre being about 2 to 4 bags (fertiliser mixture). The fertilisers may be applied with advantage about a fortnight before the crop is planted. The fertilisers should not be broadcast as the crop will not fully be benefited by this method of application. They are best applied about 6" deep in a furrow. After placing the fertiliser in the furrow the same should immediately be covered by the surrounding earth by working a plank or any other suitable implement.

Nurseries:—Having seed-beds near about the fields on which the crop is planted is useful and advantageous. Seed-beds can be raised successfully on the black cotton soils. The site selected for the seed-beds should be higher in level than the surroundings. There should be a field pond, well or some other source of assured water supply. The water should not be brackish. After working the soil to a fine tilth, raised beds about 5" to 6" height of convenient size should be formed. There should be footpaths of about 1' to 1½' between the beds. These paths will serve also as drainage channels during the rains. It is preferable that the beds have a slight gradient. Fine sand at the rate of about a ton per cent of seed-beds should be applied and worked in well. The beds may be burnt if facilities are available.

Sieved and powdered farmyard manure should be applied over the bed in a layer about 1" thick. Bordeaux mixture of moderate strength may be applied to soak the beds well about a fortnight before sowing. Sowings may be commenced from about the middle of August and continued at weekly intervals so as to make the seedlings available later on for planting throughout the planting season (October to December). A seed rate of 2½ to 3 lbs. per acre of seed-beds may be used. Good quality seed should be obtained from reliable sources. The seed should be mixed with sufficient quantity of sand and sown over the beds. After sowing, the beds should be well compacted by rolling over the bed a cement pipe of proper dimensions and weight. The bed should be kept always moist by watering with rose cans at proper intervals. A fortnight from the date of germination, either Bordeaux mixture or perenox or any other approved copper fungicide should be sprayed over the seedlings in recommended doses. The sprayings of the fungicide may be done at weekly intervals irrespective of the occurrence of fungal diseases. Insecticidal dusts or sprays like, D.D.T., Endrin etc., should also be used in proper strengths to avoid or control insect attacks. As the seedlings are growing and depending upon weather conditions, waterings of beds should be adjusted. The usual operations such as thinning, sanitary precautions, clipping of leaves, etc., should be very thoroughly observed.

FOR
MOTIHARI &
JATI VARIETIES
OF
HOOKAH TOBACCO &
WRAPPER TOBACCO

Received from
Wrapper and Hookah
Tobacco Research
Station Dinhata

hands well shaken to dislodge and destroy any adult beetles or grubs.

For the purpose of raising nursery a fertile, well drained site near the farmstead should be selected. Ploughing and planking of the nursery land may be commenced in early September. Nursery requirements of this tobacco are much the same as of jati tobacco described under Hookah Tobacco. Sowing of nursery should be done in the 3rd week of September so that 5-6 weeks old seedlings are available for planting by the end of October or early November at the latest.

(ii) MOTIHARI (N. RUSTICA)

So far as this crop is concerned there are no field operations to be performed during the months of July and August. However, if the produce is not yet sold out, due care may be taken of the produce under storage. Since during this period there would be heavy rainfall, it should be seen that the produce is stored at a safe place so as to save it from deterioration by direct or indirect entry of moisture in the bulk heaps. The bulk heaps should be given periodic turnings at the interval of 3 to 4 weeks depending upon the heat generated inside them. The bulk heaps should be given turnings before they get too hot inside.

During September, selection of nursery sites, the preparatory cultivation, manuring and other preliminaries may be arranged so that the beds are ready for sowing in the first week of October.

(i) WRAPPER TOBACCO

Wrapper leaf in storage is susceptible to serious damage by Cigarette beetle and extreme vigilance need to be exercised to guard against this pest. The produce must be stored in a cool, dry place and well protected from the damp air during rainy weather. The heaps should be kept well covered with tarpaulins. Periodical turnings of heaps should be done to check the abnormal rise of temperature and prevent beetle infestation. Bunks should be turned as far as possible in fair weather and the

(iii) Jati (N. TABACUM)

July and August :—During July and till late August, looking after the bulk heaps, if the produce is not yet sold out, would be the only major operation. Periodic turnings at the interval of 3 to 4 weeks may be given. It is necessary to store the produce at a safe place so that excessive moisture does not enter into the bulk heaps directly or indirectly. Entry of excessive moisture would damage the produce and deteriorate the quality.

September :—Selection of the site for raising nursery and its preparatory cultivation should be taken up at the end of August. Beds should be ready for sowing in the 3rd week of September. The success or failure of the crop much depends upon the availability of good sized healthy seedlings, 5-6 weeks old at the end of October.

Selection of nursery site :—Select the site for raising nursery at a high location having good drainage. The site should not be surrounded by such low lying plots, which would overflow and threaten submergence of the nursery area during the heavy rainfall period. Thus adequate quick drainage of such plots needs to be considered.

Preparation of Nursery land :—If the nursery site is cropped in early kharif season, it should be made free of stubbles etc., in late August or early September and ploughing should be commenced. Ploughings followed by laddering should be continued till a fine tilth is obtained. Thorough laddering after each ploughing would pull out and collect grass, stubbles etc., which should be removed before going over the land a second time. In all about 10-12 ploughings with as many or more ladderings should be adequate to produce a desirable tilth. After about 5 to 6 ploughings and 15-20 days prior to the sowing time well rotten farmyard manure should be applied at the rate of 20 to 25 cartloads per acre.

Lay out of the nursery :—The nursery land when ready for sowing may be laid

out into convenient sized raised beds with drainage channels all round. 6" raised beds measuring 3' to 4' in. width and 10, in length should be suitable for North Bengal region. The edges and sides of the bed should be made firm before sowing. If the nursery land is sandy the sides of the raised beds may be protected by putting paddy straw or thatch grass with support of bamboo pegs. This would prevent washing of the beds during heavy showers.

Sowing of nursery beds :—During the 3rd week of September the sowing of nursery beds at the rate of 3 to 4 lbs. per acre should be done. The sowing should be as uniform as possible. In order to ensure uniformity in sowing the required small quantity of seeds may be mixed with dry sand or powdered soil to make up bulk and sprinkled on the beds uniformly. The seeds need to be lightly mixed with soil and the bed surface makes firm by light hand pressing or by drawing a small, light plank. The beds are then left undisturbed and no watering is needed immediately after sowing. The seeds would germinate within a week. In order to ensure safety of the beds against heavy rainfall, they may be covered thinly with thatch grass or paddy straw which can be removed after the germination is over. If G.C.I. sheets are available, it is desirable to cover the beds with those sheets supported on bamboo peg about 6" high. The height of the bamboo pegs should be so adjusted that the sheet has a gentle slope to one side along its length. The sheet covers should be removed during clear weather. Waterings and weedings should be given as and when required.

PROGRAMME OF AGRICULTURAL OPERATIONS

FOR THE QUARTER JULY—SEPTEMBER

Received from Hookah and Chewing Tobacco Research Station Pusa

The preparatory cultivation of the main field and nursery areas is to be continued as and when weather conditions permit if no green manuring crop is taken. Manuring of fields with farmyard manure should also be taken up before the end of July.

In the nursery area, beds are to be prepared by the beginning of July. The beds should preferably be 4 feet in width and at least 6" raised above the ground level. The beds can be of any convenient length according to requirements. About one foot space between the beds is provided for the removal of excess of rain water and also as a pathway. Well powdered mustard cake at the rate of 25 lbs. N. per acre should be applied to the beds by the middle of July. Tobacco seed mixed with sand and fine earth should now be evenly broadcast at the rate of about 5 lbs. per acre of nursery by the end of July. Heavy seed rate which results in overcrowding of seedlings may also favour the spread of "damping off." After sowing, the beds are lightly worked with fingers to mix the seed and pressed by hand hoe (khurpi). The beds are judiciously watered by means of rose cans with fine holes. Watering should be continued to keep the surface always damp but not too wet. Weeding of the beds is to be done whenever necessary. Preparatory cultivation for the field intended for transplanting the crop should be continued. Well composted farmyard manure at the rate 40-50 cartloads is thoroughly incorporated in the land. Where

sannhemp crop is taken for green manuring, it should be buried by the end of July or beginning of August and the ploughing of land continued to bring the soil into a fine tilth. The green manure should in no case be allowed to flower before burying.

Prophylatic spraying of bordeaux mixture or perenox is to be done in the seed-beds against "damping off." The preparation of the fungicides is as follows:—

Bordeaux mixture :—One pound of copper sulphate is dissolved in 20 gallons of water in an earthen pot. In another earthen pot lime solution is prepared by adding one pound of fresh quick lime to 5 gallons of water. The copper sulphate solution is added slowly to the lime solution stirring well with a wooden piece. The mixture has to be stirred continuously till no copper deposit is obtained if a knife blade is put in the mixture for about half a minute.

Perenox :—The fungicide is made into a paste by mixing half pound of the chemical paste by mixing half pound of the chemical with a small quantity of water. Then enough water is added to make up the volume to 20 gallons.

Doses :—On an average about 6 gallons of solution is required per 100 sq.ft. of nursery. Generally as much fungi-

cide as the beds can take without overflowing can be applied each time.

The application may be repeated at the interval of a week or 10 days as per necessity to control the spread of the disease in the month of August and September. If the growth of seedlings in nursery is not satisfactory apply ammonium sulphate to accelerate the growth. Immediately after the application of the fertiliser the beds are to be watered to wash off the deposits of ammonium sulphate from the leaves.

By the beginning of September, manuring of the main field is attended. 25 lbs. N. in the form of mustard cake is applied 7 to 10 days before planting. Rest 25 lbs. N. in the form of ammonium sulphate is to be applied after one month of transplanting.

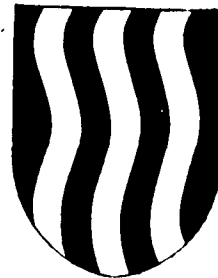
By the middle of September, the seedlings are ready for transplanting. For planting, only robust and vigorous seedlings with 6-8 leaves with good root system should be selected. The planting of tobacco crop is started by the middle of September and continued up to the middle of October. The planting is to be done in the afternoons. If the weather is cloudy and drizzling it may however commence in the morning also. For rustica tobacco the planting is delayed by about one fortnight. Spacing of 3' x 2' has been found to be optimum in N. tabacum species. Two or three pot waterings after planting are given to help in the establishment of seedlings. The gap filling should be completed within 10 days after planting because plants gap filled later rarely put on good growth and their yield is considerably reduced.

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FOR HOOKAH TOBACCO

Received from Hookah Tobacco Research Sub-Station Ferozepur

July

Generally the crop is harvested by this time. In some years (Desi Tobacco N. Tabacum) may go upto the middle of July. Efforts should be made to harvest the crop before the monsoons set in. If the harvesting is delayed, the crop will be rendered over-ripe and it will not cure properly.

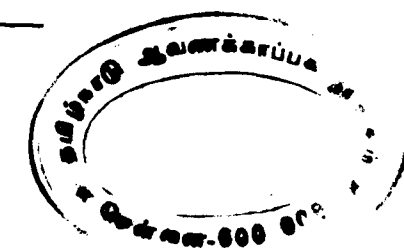
Harvesting and Curing

The harvesting is usually done in the early part of the day by cutting the whole plants and the cut plants are allowed to remain in the fields after spreading them, for partially drying for 2 to 3 days. The plants are turned upside down next morning and are brought nearer. The operation is repeated for 2 to 3 days till the harvested crop is in a proper condition for burying. This is very essential as, if the crop becomes overdry, the leaves will break and if it is wet it will rot in the pit and not produce good stuff. After proper drying, the plants are collected early in the morning when dew is on, in bundles of convenient size and buried in a pit dug in the ground. The size of pits may be of 5' x 4' x 2½'. The walls of the pits are lined with Sarkanda or weeds in order to prevent mixing of earth and the partially dried plants are arranged in layers in it. After

this top layer is covered with Sarkanda or tops or suckers of the tobacco of hessian sheets and then heaped over with earth. The top of the pit should be raised above the ground level and levelled smooth so that rain water may not get into the pit. The plants are allowed to remain in the pit for 7 to 13 days depending upon the condition of the stuff at the time of burying. If the harvested plants are wet at the time of burying, its duration of pitting should not be more than a week as due to excessive fermentation, there will be deterioration in the quality of tobacco. On the other hand, if leaves are overdried, the fermentation will be slow and hence will remain for more number of days in the pit so as to develop the desired aroma. Curing is an art in tobacco cultivation and a great care is to be exercised in this operation. After this period the plants are dug out, leaves are separated from the stalks and twisted into ropes. The ropes should be dried for couple of days and then the material is ready for marketing.

August

The stored crop should be properly looked after and it will be better if the heaps are rearranged after sometime to avoid over-heating of the stuff.



APRIL—JUNE 1958

FOR BIDI TOBACCO

Received from Agricultural Research Station Nipani

As soon as first showers of rain are received the land is given one good ploughing following with 2 or 3 harrowings. About 10 cartloads of farmyard manure is uniformly spread and harrowed well to mix it with soil. All stubbles and sticks remaining from previous harvest are removed.

Seed-bed Nursery :—The preparation of seed-bed started in last week of June is continued in July month also. Raised beds are prepared to a height of 6 inches and well packed with farmyard manure to provide a good bed. Tobacco seeds are thickly sprinkled over the bed and well mixed with soil and covered and compacted. Watering is given regularly looking to rainfall received. Whenever "Damping off" disease of seedlings is observed the beds are given spraying of 2-2-50 Bordeaux mixture to control it. The bed is greatly affected by caterpillars and regularly they are hand picked and destroyed. The seedlings will be ready by 1st week of August for first pull.

San green manuring :—As soon as enough rains are received and when the soil moisture content is sufficient by about last week of May or early June the sannhemp sowing operation starts. About 40 lbs. of sannhemp seed is drilled by means of 12" drill and the seed covered and compacted. One interculturing is given to control weeds and loosen soil. About the 3rd or 4th week of July the San crop is ready for burying. Furrows are prepared

by running an iron plough and the crop is uprooted and placed in the open furrow and while opening the second furrow it is well buried.

Transplanting of seedlings :—The seedlings are ready for transplanting in the 1st week of August. Early transplanting is done in the 1st week of August and further transplanting continued up to 1st week of September, looking to the soil and rainfall conditions of the year. Few hundred seedlings are pulled at a time and taken for transplanting and fields are marked $3\frac{1}{2}' \times 3\frac{1}{2}'$ and at each point some little quantity of water is poured and one seedling is transplanted at each place.

Insect pests and diseases :—At the time when the seedlings are establishing, caterpillars cause damage of leaves and cut worms burrow the main stem and damage the shoots. Early in the morning the caterpillars and cut-worms are hand picked and destroyed. The gaps are filled by retransplanting now and then.

Interculturings :—Looking to soil condition and rainfall light interculturings are given to control weeds and to loosen soil.

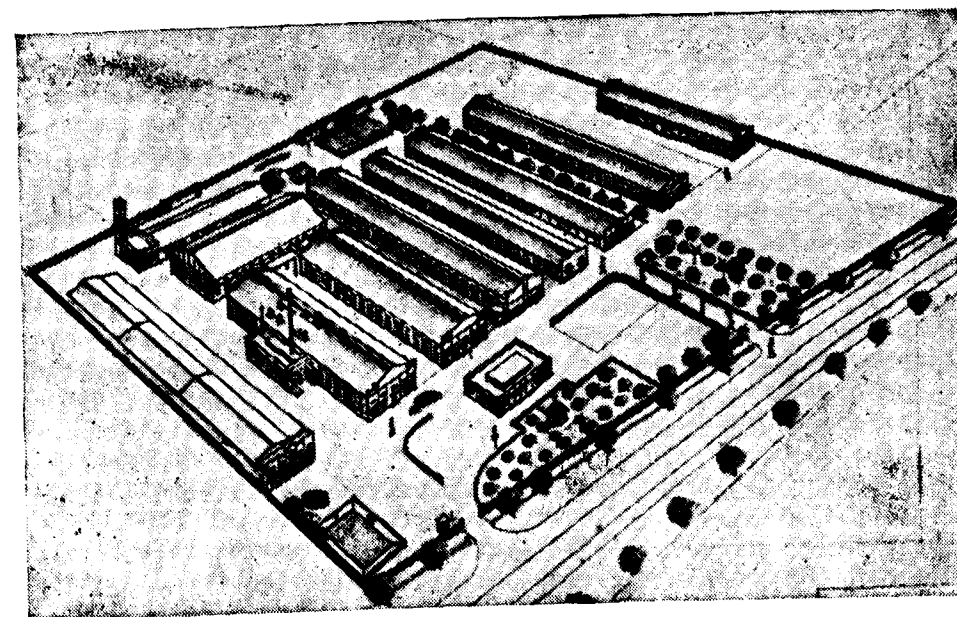
Lowering of leaves :—As the plants establish well the lower leaves are removed upto 6" from the soil. About 6-8 weeks from transplanting the tobacco crop will be ready for nipping and nipping is done keeping 12 to 14 leaves.

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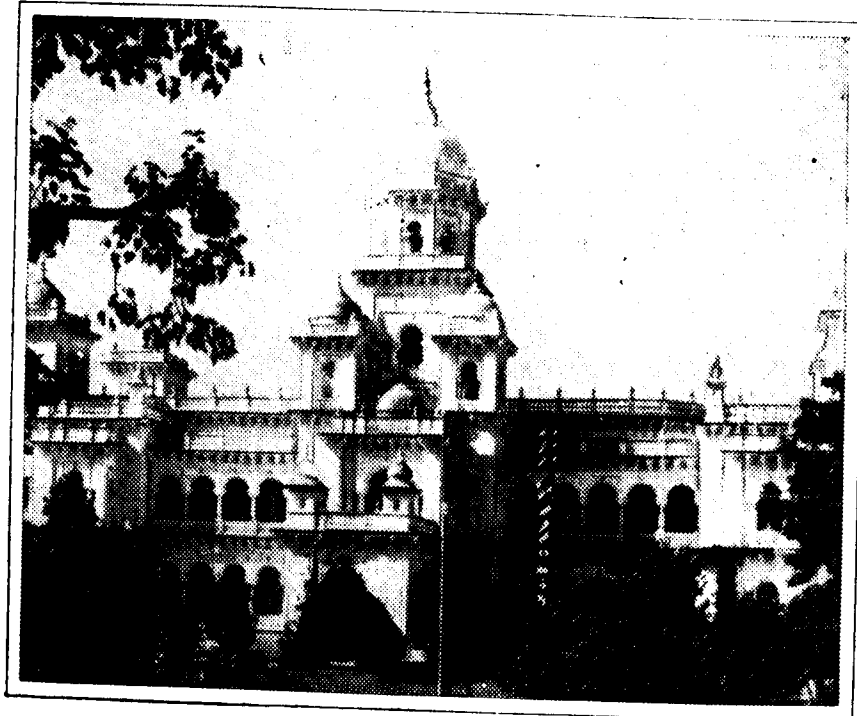
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