

Indian Tobacco

April - June, 1960



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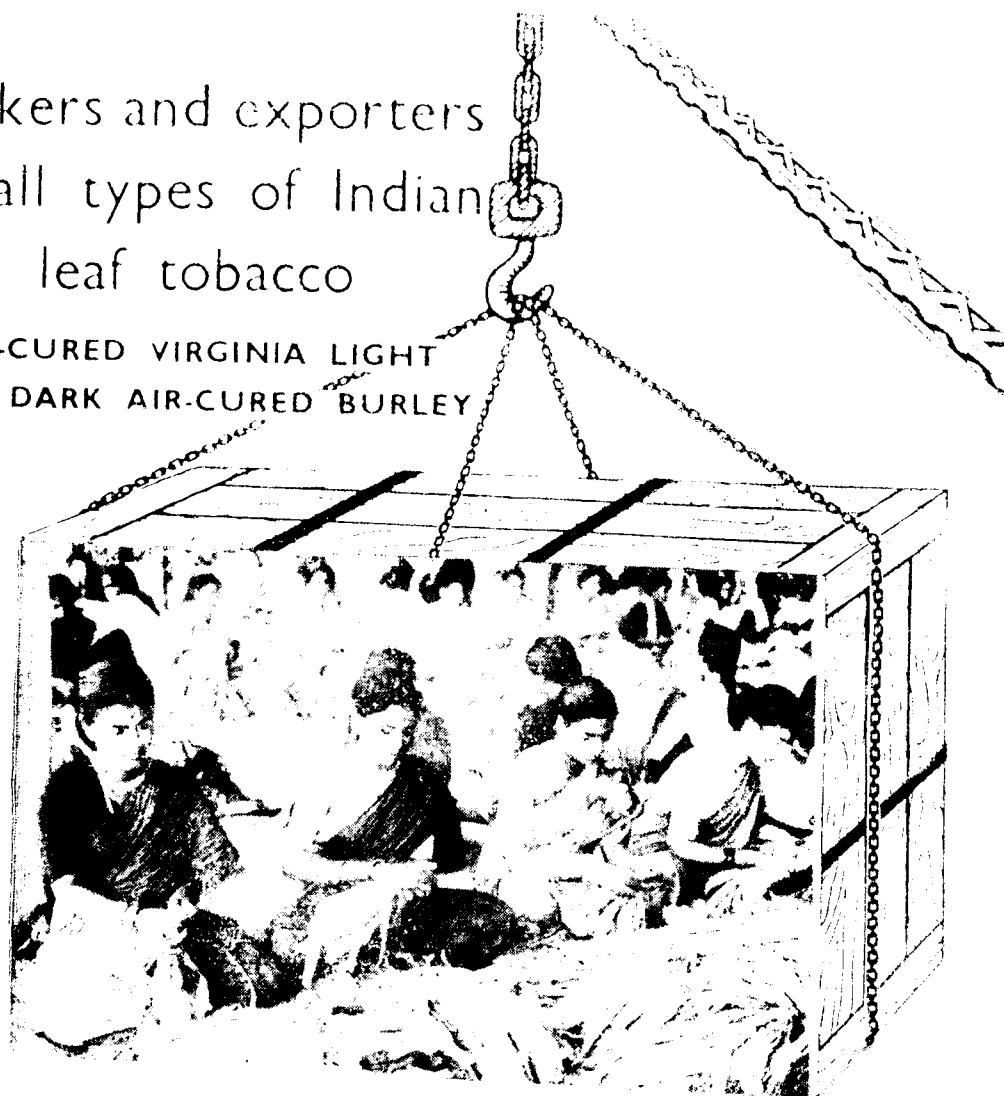
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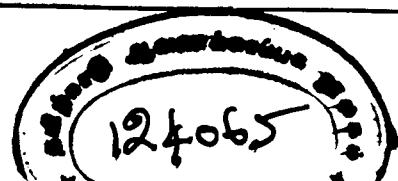
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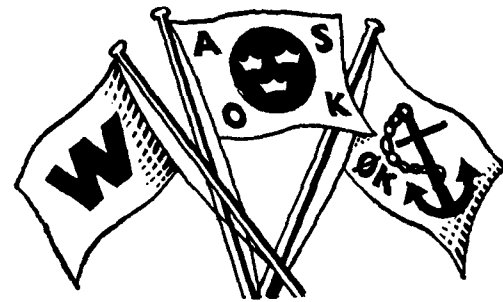
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SUMMING UP—

Periodical stock-taking is necessary in the field of commercial activity. Equally necessary it is, in the field of agricultural research. That the Second Conference of Tobacco Research Workers in India which was held in December 1959 in Anand performed this task admirably, may be known from the text of the inaugural and presidential speeches, delivered on that occasion and reproduced in this issue. Sixty delegates besides a number of observers attended this Conference, and discussions took place on fifty-two papers concerning tobacco agronomy, breeding, chemistry, physiology, entomology and pathology, besides statistics, co-operation and general problems affecting tobacco. The abstracts of papers with a summary of discussions held thereon have been brought out in the form of a separate publication. Two papers are, however, appearing in full in this issue, and subject to availability of space, text of some more papers may also be published in the subsequent issues.

Coming in the wake of similar survey on tobacco situation in S. Rhodesia and Nyasaland, and Canada published in the previous volumes, the article on "Tobacco in Ceylon" appearing in this issue, will help the readers to know better the position of our immediate neighbour in the World tobacco map. The other usual features also find their place in this issue.

M. S. PATEL,
Secretary.

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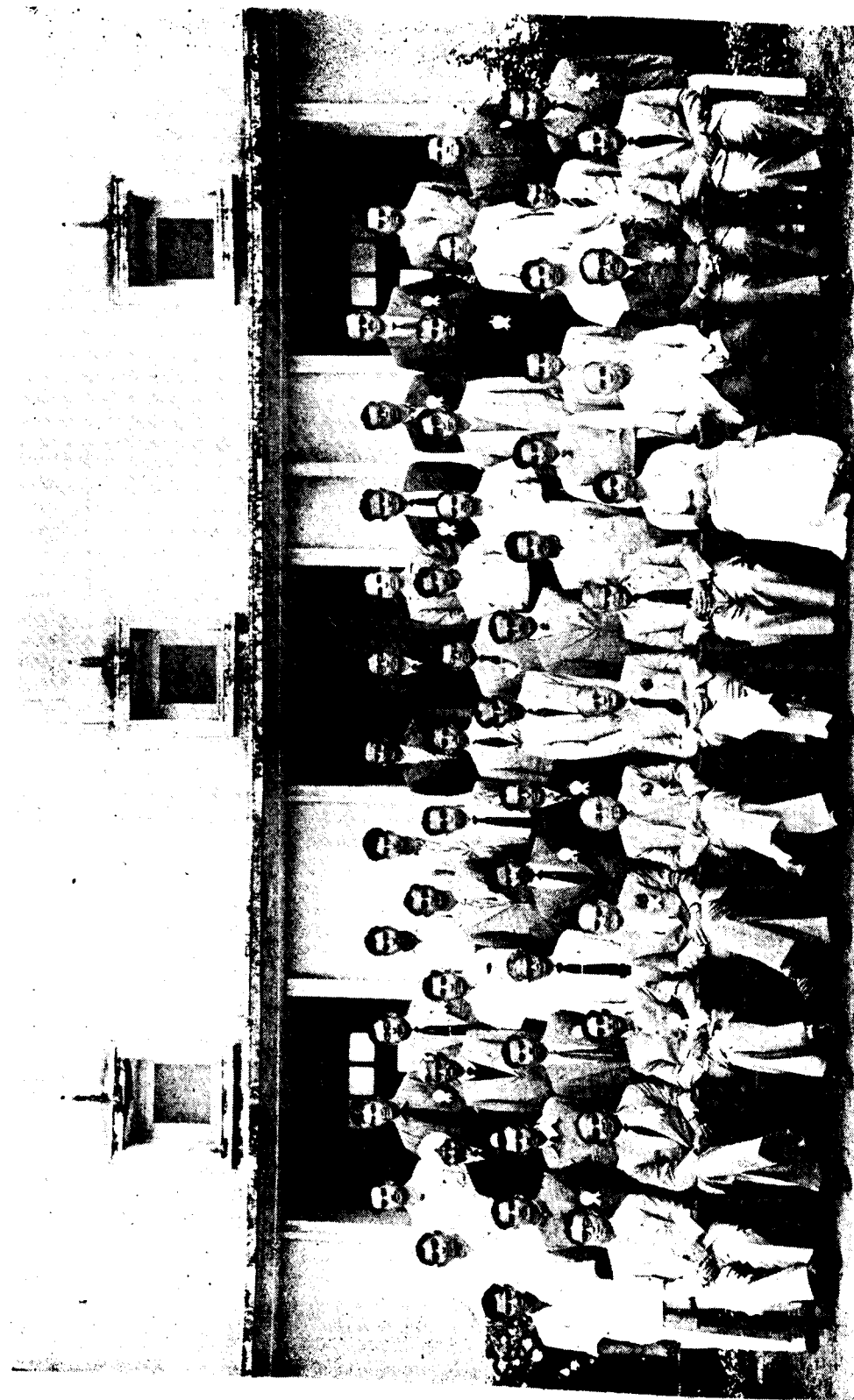


Photo showing the delegates to the Second Conference of Tobacco Research Workers, December 1959.

SECOND CONFERENCE OF TOBACCO RESEARCH WORKERS IN INDIA

The Second Conference of Tobacco Research Workers in India was held on 17th and 18th December 1959 at the Institute of Agriculture, Anand (Gujarat). It was inaugurated by Dr. M. S. Randhawa, I.C.S., Vice-President, Indian Council of Agricultural Research, and Additional Secretary to the Government of India, Ministry of Food and Agriculture, and presided over by Dr. J. S. Patel, President, Indian Central Tobacco Committee and Agricultural Commissioner with the Government of India. Sixty delegates attended both the sessions of the Conference besides a number of observers. Apart from a general paper on the 'Problems of Indian Tobacco' by the Secretary, Indian Central Tobacco Committee, 51 other papers were read at the Conference dealing in the main with the following subjects :

- (1) Genetic improvement of tobacco with particular reference to improvement of yield and quality. Cytogenetics in relation to the improvement of tobacco ; and introduction of foreign varieties and cataloguing of genetic stocks.
- (2) Agronomical practices for improvement of yield and quality of tobacco.
- (3) Growth and quality characters of tobacco as influenced by soils and nutrient supply.
- (4) Pests and diseases of tobacco.
- (5) Curing techniques for the production of quality tobacco of various types.
- (6) The role of Extension organisations and Service Co-operatives in tobacco cultivation.



Dr. M. S. Patel, Secretary, Indian Central Tobacco Committee welcoming the delegates

On 17th December 1959, the session began with the following address by Dr. M. S. Patel, Secretary of the Committee :—

“Dr. Randhawa, Dr. Patel and friends,

“On behalf of the Indian Central Tobacco Committee, I extend to you all our most hearty welcome and thank you for having readily responded to our invitation to attend this conference.

“The first conference of Tobacco Research Workers was held in Bangalore on 31st January, 1957. It was a great success. I hope this conference will also be equally successful and useful. This, I say because, today we have with us Dr. M. S. Randhawa and Dr. J. S. Patel, who are both eminent scientists and able administrators. Their presence is both a blessing and a source of encouragement to us all.

“Dr. Randhawa and Dr. Patel are not new to us. Dr. Randhawa was the President of the Indian Central Tobacco Committee and Dr. Patel was a member as Director of Agriculture, Bihar and is now the Committee's President. They are familiar with the tobacco problems. The suggestion to convene such conferences of research workers on all-India basis owes its origin to Dr. Randhawa. The series of publications on agriculture and the speed with which he has got them prepared and published will serve as a monument to his contribution to the cause of Indian agriculture.

“Fifty-two papers have been submitted for this conference and we have delegates from all over the country. Practically all tobacco growing States have been represented.

“With these few words, I request Dr. J. S. Patel to preside over the conference and Dr. M. S. Randhawa to inaugurate it.”

Dr. M. S. Randhawa then spoke :—

“Dr. Patel, Ladies and Gentlemen,

“I wish to express my sincere thanks for inviting me to inaugurate the Second Conference of Tobacco Research Workers in India. The First Conference of Tobacco Research Workers was held at Bangalore in 1957, and we thought it would be useful to review the work done since then. Hence this conference.

“I am glad that this conference has been held at Anand, situated in the heart of tobacco growing area of Kaira district which is well-known for the production of bidi tobacco of good quality. At this Institute, investigations on the various aspects of bidi tobacco have been in progress for a number of years and some outstanding results have been achieved. The Institute with its laboratories, college and the farm provides a suitable environment for a conference of this nature.

“We are thankful to Dr. M. D. Patel, the Director of the Institute for making it possible for us to meet here.

“You are all aware that tobacco occupies an important place in the agricultural economy of our country, providing employment to tens of thousands of workers in the different fields of production and industry. The value of tobacco produced is estimated to be about Rs. 40 crores per annum. About Rs. 36 crores is realised annually by the Central Exchequer as excise duty, which is by far the largest amount collected from any single crop. Besides, it earns for the country about Rs. 12 crores as foreign exchange.

“In the context of maintaining the export of Indian tobacco in a highly competitive market, the quality of the leaf is of paramount importance. Some of the importing countries are either in a position to get tobacco from other sources or are able to produce it themselves. This is especially the case with cigarette tobacco which is the principal earner of foreign exchange. With improvement in the



Dr. M. S. Randhawa, Vice-President, Indian Council of Agricultural Research, delivering the inaugural address

standard of living, there would be greater demand for better quality tobacco even for internal consumption.

“There are bright prospects of establishing new markets in foreign countries for the *natu* tobacco which is extensively grown in Guntur area of Andhra Pradesh. This tobacco has got pleasant aroma, and is being used in the manufacture of cheap cigarettes which have been well received by smokers abroad. Since there are certain problems connected with this type of tobacco, such as improvement of the burning quality, I would suggest that a programme of research on *natu* tobacco should be undertaken.

“We are at present importing very small quantities of good quality wrapper tobacco and Virginia tobacco from U.S.A. So far as the wrapper tobacco is concerned we have been trying to produce leaf of the required quality under Indian conditions, and research work done during the last few years has given en-

couraging results. Our ultimate aim should be that we are self-sufficient in these tobaccos also.

“The different types of tobacco require different methods of cultivation, manuring, harvesting, curing and processing so that they become suitable for the purpose for which they are intended, such as cigarettes, cigars, cheroots, bidis, chuttas, pipe, hookah, chewing and snuff. To cite some examples, the cigarette tobacco is generally not topped, and the cigar and cheroot tobaccos in South India receive a mild topping while the bidi and chewing tobaccos are topped heavily, leaving about 8 to 10 leaves per plant.

“The flue-cured Virginia tobacco is grown almost under very little nitrogen, while the cigar and cheroot tobaccos receive about 150 to 200 lbs. N per acre. The bidi tobacco receives about 160 to 200 lbs. N per acre. While flue-cured Virginia tobacco is rapidly cured, the cigar and chewing tobaccos are subjected

to a slower curing process. In the case of cigar tobacco the leaf should be of uniform brown colour with good body, while in the chewing tobacco the leaf should be highly hygroscopic with ability to absorb flavourings. It is therefore clear that a sound knowledge of raising the nurseries, soil management, field culture, suitable varieties, crop protection against pests and diseases, and efficient curing and processing methods is most essential in order to bring about the right sort of physical and biochemical changes in the produce. In addition to the above, there are problems of storage and packing which have also to be attended to by the research workers.

"Quality in tobacco, as you all know, depends upon certain specific characters of the green leaf and on the manner and method by which the material is cured. Intensive research on this aspect has to be carried out so that not only leaves possessing the most desirable characters are produced, but the best that is in them is brought out by proper methods of curing and processing. In the case of bidi tobacco, quality is attributed to the specific characters of spangling and puckering. What exactly is the nature of spangling and puckering, from the biological and chemical points of view, has to be determined. Also the genetic nature of these important attributes of quality should be found out.

"So far, research work on the quality aspects of cigarette tobacco has been confined to the production of bright grades through improved cultural practices, improved curing techniques and introduction of better varieties. Beyond this, further study as to what exactly is meant by quality from the manufacturing point of view, has not been made. Even after curing the leaf, there are several processes like bulking, redrying, ageing and fermentation during which the leaf undergoes many biochemical changes. Critical studies of these post-curing processes are very important and

they should be combined and co-ordinated with studies conducted in the field. It is only then that we will be in a position to build up an integrated picture of 'quality' as expressed by the manufacturer, and to produce tobacco of the required specifications for catering to the needs of the industry at home and abroad. By starting research work on what may be called the technological aspects we will not only help the grower and the industry, but the country at large.

"I am glad to learn that attempts are being made to adopt some of the latest plant breeding techniques in the improvement of the tobacco crop. Exploitation of hybrid vigour is being utilised in hookah tobacco in increasing the yield and leaf size consistent with quality, and hybrid seed is being produced for large scale distribution at the Tobacco Research Station, Ferozepore. Attempts have been made to induce mutations by subjecting the seed of some of the more important *N. tabacum* varieties to irradiation at Trombay, and the treated material is being grown at the Central Tobacco Research Institute, Rajahmundry. Facilities for irradiation are also available at the Cobalt 60 Gamma field at Indian Agricultural Research Institute, New Delhi and these should also be used for inducing mutations in tobacco. The results of this work will be watched with interest. It has been possible to successfully produce a trispecific hybrid involving *N. tabacum*, *N. glutinosa* and *N. trigonophylla*. This hybrid might offer possibilities for transferring the *glutinosa* type of mosaic resistance into the commercial varieties of cigarette tobacco. The amphidiploid of a cross between *N. tabacum* and *N. glauca* has been successfully produced and this material is valuable for breeding for nematode-resistance. Attempts to make crosses with other species like *N. repanda*, *debneyii*, *alata* and *plumbaginifolia* have also been successful. Although the results are of

a preliminary nature, the possibilities which this line of work offers are encouraging.

"A serious problem in the tobacco growing areas is the incidence of nematodes which devastate large tracts. Although some proprietary fumigants are reported to be effective in reducing the incidence, the high cost involved, and the need for proper equipment would perhaps restrict the adoption of this method by the average farmers on a large scale. Moreover, this method of control is not a permanent solution because, fresh incidence may occur from other infected areas. Simple and more economical remedies such as proper crop rotation should be evolved. The most effective method of control, however, would be the breeding of varieties resistant to root-knot infection, and I hope you would consider this problem.

"The results of research can be made useful to the farmer only through proper extension work. The grower should be supplied with pure seed of the improved varieties. Fertilisers as well as necessary implements should also be made available to him at reasonable price and the proper method of using them should be fully explained to him. It is only then that we can expect the grower to produce leaf of the required quality. It should be recognised that the reputation of Indian tobacco, and possibilities of increasing the exports of this commodity depend largely on the efforts of the individual growers, and on the success of the Department to help them in this task. All these can be accomplished only if Service Co-operatives are established in the major tobacco growing areas and the needs of the growers in the matter of production and marketing are carefully looked into.

"I also draw your attention to the paper presented by the Committee's Secretary, Dr. M. S. Patel which sums up the tobacco problems from the view point of the grower, trader and the researcher.

"I will not take any more of your time and hope that you will profit by the discussions and exchange of ideas at this conference.

"While thanking you once again, I have great pleasure in inaugurating this conference."

Dr. J. S. Patel then delivered his presidential address as follows :—

"Dr. Randhawa, Ladies and Gentlemen,

"I consider it a great privilege to have been invited to preside over the Second Conference of Tobacco Research Workers in India. As I have taken over the Presidentship of the Indian Central Tobacco Committee only recently, I am glad to have this opportunity for gaining a first hand knowledge of the research work that is being carried out on tobacco.

"At the First Tobacco Research Workers' Conference held at Bangalore in the beginning of 1957, the important results obtained through research at the various centres had been brought out and since then much progress has been made. I would like to mention briefly some of the important results achieved and possible lines on which the future work should be based.

"Since tobacco is a transplanted crop, its successful production depends on the successful raising of seedlings in the seed beds. In the case of cigarette tobacco, the field crop is raised on the heavy black soils of Andhra Pradesh and in view of the conditions prevailing during the nursery season it was not considered possible to successfully raise the seedlings on the lands where the transplanted crop is grown. The growers therefore obtain the seedlings from nurseries located in the sandy areas of Bapatla and Chirala in the Guntur District, thereby incurring heavy cost of transport. As it would be much more profitable to produce the seedlings of the desirable type on the same site, experiments were conducted at the Central Tobacco Research Institute for overcoming



Dr. J. S. Patel, Agricultural Commissioner with the Government of India and President of the Committee delivering the presidential address

these difficulties. The recommendations from this work are :

- (1) Application of farmyard manure as a layer ;
- (2) Rabbing the seed beds and mixing the ash with the top soil ; and
- (3) Adoption of a schedule of spraying fungicides for the control of ' damping off '.

" Since these recommendations involve the use of large quantities of farmyard manure which are not readily available, further work has been taken up to see if inorganic fertilisers could be substituted. It has been found that application of superphosphate at the time of sowing gives very good germination and stand, and if this is followed by the application of nitrogenous fertiliser in split doses as top-dressing, the growth of the seedlings is very satisfactory. The overall effect of this method of raising the nursery appears to be as good as that involving the use of a layer of farmyard manure.

" In raising bidi tobacco nurseries the farmers have to use large quantities of farmyard manure. To get over this difficulty certain experiments were conducted at Anand. It was found that application of 160 lbs. N per acre in the form of castor cake composted for one to two weeks gave the maximum number of transplants. In view of the high cost and non-availability of large quantities of castor cake, further experiments were conducted to see whether the castor cake could be partly or fully replaced by inorganic nitrogen. The results of these trials have indicated that equal quantities of nitrogen can be applied successfully in the form of castor cake and ammonium sulphate.

" As the cultivation of cigarette tobacco has been found to be profitable and as there is a good demand for this tobacco in the international market, there is a real risk of its area being extended over low-quality producing tracts in Andhra Pradesh. We have to guard that the tobacco does not spread to saline,

inundated and low lying lands. Although the leaf produced on such lands appears bright in colour in the beginning, it loses this colour rapidly in storage and will not burn well. If the soil is depleted, it produces pale faced tobacco. I am glad that the Committee has realised this danger and the Central Institute has already done a preliminary survey in the cigarette tobacco tract of the Bapatla and Ongole taluks of Guntur District.

" *Natu* tobacco is produced in Andhra Pradesh on a large area. It is used in the manufacture of cheap cigarettes and in pipe mixtures. This tobacco also suffers in quality if cultivated on highly saline lands. An area of 260 sq. miles in Ongole taluk has been surveyed. To work out the limits of tolerance of this variety, soil samples collected from good, medium and poor regions were analysed. It was found that soils with more than 0.01% chlorine generally produced leaf with poor burn. On this basis a tentative area of 18 sq. miles of scattered patches has been demarcated as unsuitable for *natu* tobacco.

" Studies on the injurious effect of sodium salts present in irrigation water on bidi tobacco showed that irrespective of the nature of the anions, nicotine, total sugars and starch contents decreased with the increase in the salt concentration, showing thereby that sodium salts are definitely harmful for leaf-quality.

" In the Third Five-Year Plan, a scheme for a detailed soil survey of the tobacco growing areas in Andhra Pradesh, Mysore and Bombay States has been proposed, for demarcating the areas that are saline so as to advise the farmers not to grow tobacco on such lands.

" A Soil Testing Unit has been established at the Central Tobacco Research Institute under the auspices of the T. C. M. and in collaboration with the Indian Agricultural Research Institute. The function of the Unit is to do rapid soil testing, to work out manual schedules and to make suitable recommen-

dations to the growers. The testing work done by this Unit will have to be followed up by agronomical experiments with a view to correlating the actual response of the crop to the application of fertilisers.

" Cigarette tobacco is grown under conditions of low nitrogen since excess of nitrogen produces dark and coarse leaves which are not fit for curing. In cigarette tobacco the problem of increasing yield as well as improving the quality of leaf is therefore not easy of solution. Though most of the tobacco produced in the country is used for internal consumption, a major portion of the cigarette tobacco is exported. Indian cigarette tobacco is noted for its golden yellow colour and neutral flavour but lately with the growing popularity of filter-tip cigarettes, there is a shift towards tobacco of better body and aroma. In addition to the desirable qualities already existing in our tobacco we should endeavour to develop qualities such as good body and right aroma which are necessary to maintain our prominent position in the international trade.

" In the case of other smoking tobaccos like cigar, cheroot, hookah and bidi where quality requirements are not so critical, it has been possible to recommend the application of fairly heavy doses of nitrogenous fertilisers in addition to P_2O_5 and K_2O to boost up the yield. Past experiments have shown that under the existing system of cultural practices the cigarette tobacco crop responds only to 20 lbs. N per acre and there is no response to application of P_2O_5 and K_2O , but with deep placement of the complete fertiliser there are indications of response to even P_2O_5 and K_2O . Since the urgent need in cigarette tobacco is for quality, attempts have been made to improve it through improved agronomical practices. A combination of cultural practices involving deep cultivation in summer, deep placement of fertiliser, and conservation of soil moisture after the transplantation of the crop through artificial

mulching with paddy straw has been tried out at the Central Tobacco Research Institute for a number of seasons and the results have been very encouraging. These improved cultural practices have been recommended for wider adoption by the growers through the agency of the State Extension staff. For deep application of the fertiliser, a simple bullock drawn implement has been fabricated at the Central Institute.

"The introduction of the new cigarette tobacco variety 'Delcrest' which is acclaimed to be one of the best varieties in Southern Rhodesia has proved successful in our country. This variety which has been included in the varietal trial at the Central Institute has given a consistently good performance. It has given a higher percentage of bright grades uniformly in all the curings, as compared to the commercial varieties now under cultivation. Based on these results the variety has been put under demonstration trials in the different cigarette tobacco growing regions of Andhra Pradesh and the results of the first year's trials are quite encouraging. It is hoped that this superior variety will soon replace the existing variety Harrison Special which has been under cultivation since the introduction of flue-cured Virginia tobacco in our country. The Central Tobacco Research Institute has also succeeded in evolving by selection an improved strain, Lanka-27, superior in yield and quality to the local types grown in the islands of the Godavari Division. At Pusa, an improved strain of hookah and chewing tobacco (Bori Bharao-10) has been evolved through selection from the local bulk. Another achievement in respect of hookah tobacco is the evolution of the improved strains T-17 (*N. tabacum*) and T-238 (*N. rustica*) at the Tobacco Research Station, Ferozepore. It has been possible to replace the existing wrapper variety, Rangpur Sumatra by Dixie Shade, a variety introduced from U.S.A. At Anand, in bidi tobacco, two

important strains, K-49 and K-20 have been obtained through selection from local bulks. At the same station an improved strain of chewing tobacco P-4 has been recently evolved, replacing the earlier selection P-98.

"Exploitation of hybrid-vigour has been found possible in hookah tobacco and large scale production of hybrid seed is being taken up for distribution. I am confident that if this method is adopted in other types of tobacco like bidi, chewing, cigar, etc., it would give useful results.

"The tobacco crop in India is attacked by a number of diseases such as Mosaic, leaf curl, bacterial and fungal wilt, spot diseases, powdery mildew, chitri, etc. It is well recognised that, wherever feasible, breeding for disease resistance is the most satisfactory solution. Types of tobacco having the required degree of natural resistance have to be located. Attempts to transfer disease resistance from related wild species usually lead to complications like sterility, reduction in yield, lowering of quality, etc. Fertility has to be restored and linkages between disease resistance and undesirable wild characters have to be broken. In some cases, there is antagonism between hybrid embryo and the maternal tissues. At one time, these difficulties were virtually insurmountable but recent developments such as irradiation, embryo-culture, etc., have paved the way for breaking genetic barriers. It is my earnest hope that our scientists will adopt these latest techniques in the breeding methods and that they would succeed in evolving resistant varieties without sacrificing yield and quality. It is only then that this line of work would lead to results of practical value.

"Since virus diseases are assuming serious proportions in certain areas, special attention has to be paid to their study. Hunsur, where a Tobacco Research Station has been established under the Second Five Year Plan, appears to be ideal for this line of work and

I am glad that the Indian Central Tobacco Committee, preliminary to the proposal for a thorough study of virus diseases in the Third Five Year Plan, has sanctioned a scheme for the survey of virus diseases prevalent in the cigarette tobacco growing areas of Mysore and Andhra Pradesh.

"I would like to refer to another important problem, namely, the severe damage caused by nematodes. We do not have any specially qualified nematologist in our country and it is essential that we train the necessary personnel.

"Before I conclude my talk I would like to touch upon another aspect of tobacco production, namely, the important attributes of commercial quality. In the case of tobacco, the farmer cannot get any return by merely producing the crop of the right type on the field. This has to be followed up by successful curing. Bad leaf cannot be improved by curing, but good leaf can be spoiled by bad and defective curing. The process of curing has an intimate bearing on the quality of the final product. It should be remembered that during the process of curing, some important biochemical changes take place. In the case of f.c.v. tobacco, a high ratio of carbohydrates (such as starch and sugar) to nitrogen and

of potash to chlorine are the chief factors responsible for desirable ash characters and good burn. In addition to these, the leaf should be good bodied with a golden yellow colour which does not change or darken during storage. It should also possess elasticity and sufficient oiliness. Though some of the characters are varietal and gene-controlled, it is the process of curing that brings about the conversion of carbohydrates into sugar and stoppage of the disintegration of proteins and organic acids. In the subsequent drying and bulking of the cured leaf, the desired degree of fermentation takes place. All these changes are successfully brought about in the barns by proper adjustment of temperature and humidity during the process of curing. The Central Institute has evolved a modified schedule of curing and this has been found to be beneficial in improving the proportion of bright grades as well as in reducing the consumption of fuel. Some modifications have also been brought about in the construction of the barns. As regards other tobaccos, though quality is not of such critical importance as in f.c.v. tobacco, it is necessary to study the changes that take place during the various stages of curing with a view to effecting possible improvements in the exist-



Dr. G. S. Murty, Director, Tobacco Research, proposing vote of thanks.

ing methods. In these tobaccos also, it is highly essential to study what changes take place from the time the leaf is harvested upto the time it becomes the finished product.

"Quality in bidi tobacco is closely linked with the development of spangling and puckering. The bidi tobacco buyers are offering prices to the different grades of tobacco according to the existing system of buying. It was thought necessary to find out whether there was correlation between the prices offered by the merchants and the chemical constituents of the leaf. Statistical analysis of the data on the various chemical constituents of the individual leaves based on their position on the stalk carried out at Bidi Tobacco Research Station, Anand, indicated that nitrogen is the only chief constituent that plays a major part in determining quality. To further corroborate this finding, trade samples falling within various price groups as purchased by the merchants had been collected from different regions in

the Charotar area and analysed for this constituent, and the chemical analysis revealed the existence of a positive correlation between nitrogen content and the price level; the higher the nitrogen the better the price. Further studies have shown that besides nitrogen, calcium also plays an important part in determining the quality in this tobacco, the lower the calcium content, the better the quality. This study is being continued and is extended to trade samples from Nipani tract also.

"Based on this study of the chemical analysis, it has been found possible to classify the bidi tobacco leaves on each plant into two distinct groups, the upper five leaves and the lower five. The upper ones were superior in quality to the lower. These studies have great potentialities in laying down grade standards for bidi tobacco and the work should be strengthened.

"I am confident that the opportunity which this conference is affording to the scientists in



The Conference in session.

Photos: J. H. Kapadia.

INDIAN TOBACCO

the different tobacco growing areas for taking stock of the progress made so far and for exchanging views about future lines of work, augurs well for tobacco research in the country. It is particularly appropriate that this conference is being held on the eve of the Third Five Year Plan. I hope that in your deliberations you will keep this in view and see that the future lines of work which you propose to take up will fit into the fabric of nation building during the Third Plan period.

"We are very fortunate in having with us today Dr. M. S. Randhawa, who is not only an eminent administrator but also a distinguished scientist. It is our good fortune that the next agricultural plan is being shaped by his skilled and sympathetic hands. We are

grateful that he has found time to inaugurate our conference and inspire us by his presence."

Dr. G. S. Murty, Director, Tobacco Research, proposed a vote of thanks to Dr. M. S. Randhawa, Dr. J. S. Patel and other delegates. He also thanked Dr. M. D. Patel, Director, Institute of Agriculture, Anand, for the facilities extended to the delegates and for the excellent arrangements made for holding the conference.

On 17th and 18th, the delegates read their papers, on which discussions were held.

On the evening of the 17th, the delegates visited the farm of Shri. Raojibhai Patel at Sarsa near Anand and appreciated the bumper bidi tobacco crop raised by him by adopting the improved methods recommended by the Committee's Bidi Tobacco Research Scheme.

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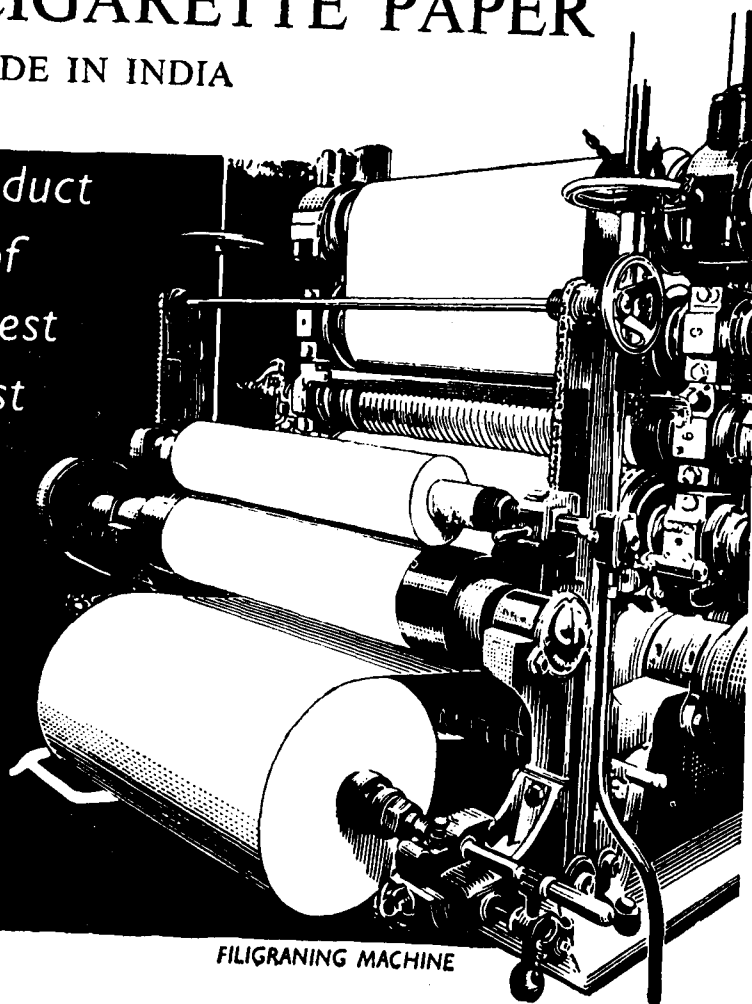
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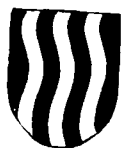
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INDIAN TOBACCO

TOBACCO IN CEYLON

Dr. M. S. PATEL, M.Sc., Ph.D. (N. Carolina) *
and P. N. B. PILLAI, M.A.**

The introduction of tobacco in Ceylon dates back to the 17th century, between the years 1600 and 1612. In the early stages, only the strong, dark air-cured variety of the *Nicotiana tabacum* was grown, solely for medicinal purposes on small plots, scattered throughout the Island. Later, its properties as a mild narcotic, to relax and soothe the nerves came to be known.

The Government of Ceylon realised the rich potentialities of tobacco cultivation as a source of revenue and duties were imposed on its transport and sale. By 1678, so profitable had tobacco cultivation become that the Government was forced to intervene with mild legislation to restrain its indiscriminate planting in areas more suitable for food crops. At the close of the 17th century, tobacco was being grown in many parts of the Island such as Kandyan Provinces, Vanni, Jaffna, Trincomallee, etc.

Throughout the early years of the British rule, Jaffna steadily increased its lead over other parts of the Island in tobacco cultivation by the application of carefully considered methods to foster the plant and reap abundant harvests by evolving new techniques specially adopted to suit the taste of consumers. Most of the exports during this period was to the erstwhile Travancore State.

By about 1840, a fine quality of tobacco was being produced at Dumbara and in the

Uva Valley, deriving its excellence from the lime-stone formation below the surface. An experimental plantation grown specially from imported Havana seed was set up by this time. This was withdrawn as it did not realise the expectations fully.

The possibilities of growing White Burley for pipe smoking and cigarette blending was explored in 1917. Till 1931, the whole of the organisation of giving out seed, supervision, collection of leaf, etc. was by the Department of Agriculture. In 1931, the White Burley Tobacco Sale Society was formed.

During the World War II, the cost of production began to increase without a corresponding increase in the sale price of tobacco produce. As a result, there was a set-back in the cultivation of cigarette tobacco.

The pattern of domestic production and utilisation changed little till 1947, when commercial production of flue-cured Virginia type of tobacco was first attained. This new planting together with an increase in the acreage of mild cigar tobacco, was responsible for the gain in acreage over the pre-war years.

ACREAGE AND PRODUCTION

The total area planted under tobacco annually during the pre-war period averaged about 8,000 acres. Production was about 5 million lb. The following table gives the sta-

* Secretary, Indian Central Tobacco Committee and Member, Tobacco Export Promotion Council and Tobacco Regional Advisory Committees of the various Central Excise Collectorate in India.

** Statistician, Indian Central Tobacco Committee.

tistics of acreage and production in recent years :

Year	Acreage (in acres)	Production (in 000 lb.)
1950	9,700	5,841
1951	11,200	6,619
1952 *	12,400	8,136
1953 *	13,625	8,089
1954	13,000	6,700
1955	12,000	8,500
1956	15,000	8,700
1957 @	15,000	8,700
1958 @	15,000	7,900

* Refer only to cigarette tobacco, chewing tobacco, bidi tobacco and cheroot tobacco.

@ Preliminary.

Sources :—Reports of the United States Department of Agriculture.

Report of the Commission on tobacco products industry, Ceylon.

As can be seen from the table, the acreage and production during the last 3 years have remained more or less steady.

The most important tobacco growing districts in Ceylon are the Jaffna Peninsula in the north, the Dumbara valley, Matale North and Nuwara Eliya District in the Central Province, Hiriyala-Hatpattu in the North Western Province and Polonnaruwa District in North Central Province. The important cigarette tobacco growing areas are Dumbara valley in Kandy District, Hanguranketta, Walapona and Nildandahenna in Nuwara Eliya District, Matale North in Matale District, Wariyapola and Nikawaratiya in Kurunegala District, Hingurkgoda, Polonnaruwa and Elahera in Polonnaruwa District and Jaffna Peninsula in Jaffna District.

The Jaffna tobacco has gained popularity chiefly because of its agreeable taste and flavour for chewing. It is also used for cheroots because of its aroma and neutral qualities.

The Dumbara valley tobacco has been successfully crossed with milder and lighter strains. Production of this variety is being expanded substantially to meet the increased demand for its use as a filler in mild cigars and for blending purposes in cigarettes. The Hiriyala-Hetpattu tobacco is used principally for chewing and in making cigars.

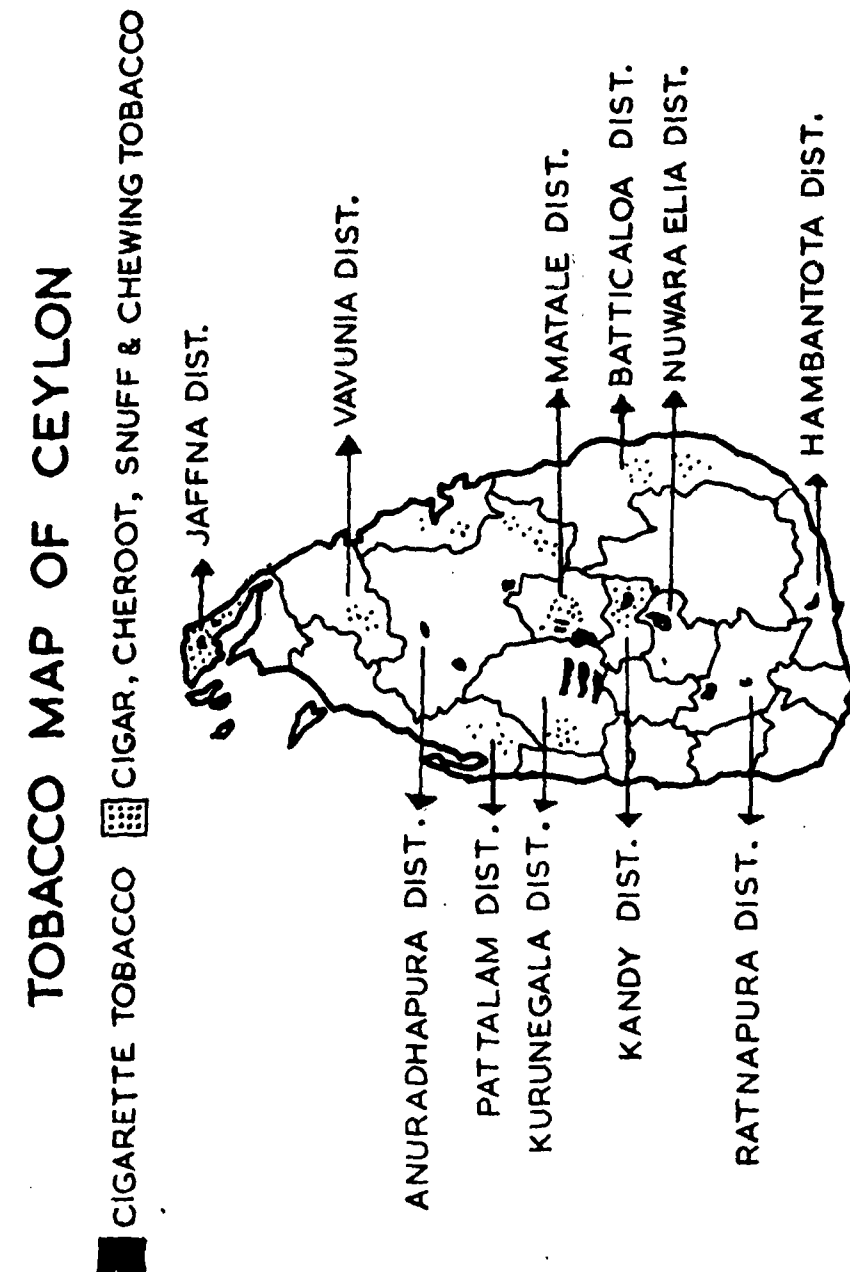
Flue-cured tobacco production in Ceylon began only in 1947. Each year, two crops of flue-cured tobacco are produced. One is set out after the heavy rains in autumn and the other during the light spring rains. For the autumn crop, seeds are sown in October and November, the tobacco is transplanted in December and January and the harvesting is done in March and April. Seeds are sown for the spring crop in April and May and tobacco transplanted in May and June for harvesting in August and September. Flue-cured tobacco is mostly produced at Hanguranketta, Teldenia and Kurunegala, each near the town of Kandy in the Central Province. In 1954-55 one of the tobacco manufacturing companies had 7 buying depots, 150 flue-curing barns and two tobacco storage warehouses in these provinces. More barns are being constructed and the plans are to increase production substantially.

The estimated acreage and production of flue-cured tobacco during the last five years are given below :

Year	Acreage (acres)	Production (000 lb.)
1954	5,000	2,500
1955	5,000	3,400
1956	7,000	3,600
1957 *	7,000	3,600
1958 *	7,000	3,500

* Preliminary.

Source :—Reports of the United States Department of Agriculture.





Pricking of tobacco seedlings.



One and a half month old cigarette tobacco crop (Harrison Special).

CURING, GRADING AND MANUFACTURING

In Ceylon, different types of tobacco are subjected to different methods of curing. Virginia leaf for cigarette manufacture is usually flue-cured. The flue-curing barns are lightly constructed, provided with suitable ventilators and metallised flue-pipes extending from wood-fired furnaces around the floor of the barn.

The tobacco leaves of Dumbara are primed and cured on strings in open sheds. The leaves which are removed with pieces of stalk are staked in a thin layer on the ground of the curing shed. They are allowed to remain till they are fully dried. Tobacco cured by this method is used for the manufacture of cigars, mild cheroots and cigarettes.

The leaves of the strong cheroot tobacco are hung up in the open shed. After three days, they are packed tightly in a circular pit. Tobacco is thus left to ferment for about 4 days after which it is taken out and hung up in a smoke-curing shed and smoked for one night only. After smoking, the leaves are hung up in an air-curing shed till the midribs are thoroughly dry. This method of curing is rather old and no modifications have since been made.

Hiriyala chewing tobacco leaves are first exposed to sun for a few minutes and then collected and kept within a shed which is partly closed and does not permit a free circulation of air. The leaves are bulked and rebulked twice a day in the shed. Selective exposure of leaf to the sun is continued and the period of exposure is increased daily. Curing of this type of tobacco is a very tedious operation lasting for about 22 days.

The types of tobacco cultivated in Ceylon and their methods of curing are given below :

- | | | |
|-----------------------|----|---------------|
| 1. Harrison's Special | .. | Flue-cured |
| 2. Dumbara | .. | Air-cured |
| 3. Malayalam | } | .. Pit-cured |
| Jaffna | | |
| Hiriyala | | |
| 4. Jaffna | } | .. Fire-cured |
| Pallai | | |
| Thambankaduwa | | |
| 5. Bidi | .. | Sun-cured |

After curing, the leaves are graded according to colour, position of leaf on the plant and other recognisable elements of quality such as elasticity of leaf, texture, width, uniformity, etc.

In the case of flue-cured leaf, colour is the chief criterion. There are four grades of such leaf. The recognised grades in the cigar tobacco leaf could be divided as wrapper, binder and filler. The Malayalam chewing tobacco is graded into 10 grades according to size, body and texture.

Due to warehousing difficulties, the process of ageing and fermentation is seldom done in Ceylon except in the case of cigarette tobacco. The period varies from 1 to 3 years.

CIGARETTE AND PIPE TOBACCO

The different types of leaf tobacco required for the manufacture of cigarette and pipe tobacco are partly produced in Ceylon and partly imported from countries such as U.S.A., India and Southern Rhodesia.

The first cigarette manufacturing company established in Ceylon over half a century ago imported cigarettes for home consumption. It started manufacturing cigarettes in 1928 with imported leaf. In 1930's cigarettes were manufactured by using local leaf blended with imported leaf. This establishment also manufactures pipe tobacco.



Topping of cigarette tobacco.



Malayalam tobacco crop.

The second establishment came into being in 1937 which eventually sold its business to another in 1940. Besides these, there are two modern factories in operation. The production of cigarettes in the two establishments (which produced the major portion) was :

Year	No. of cigarettes (in millions)
1949-50	1,003
1950-51	1,353
1951-52	1,528
1952-53	1,492
1953-54	1,410
1954-55	1,380
1955-56	1,410

Latest figures are not available.

Source :—Report of the Commission on Tobacco Products Industry and U.S. Department of Agriculture.

The production in other two establishments was between 90 and 150 million.

The cultivation of cigarette tobacco is now encouraged through Co-operative Societies with assistance from the Department of Agriculture and cigarette manufacturing companies. Under the Long Term Plan for cigarette tobacco production, Government gives the following financial assistance to the cigarette tobacco growers through Co-operative Societies :

- Medium Term loans at 2% interest recoverable in ten annual instalments for construction of flue-curing barns, handling sheds and curers' quarters.
- Short Term loans at 2% interest recoverable in 6 months for raising seedlings, purchase of fertilizers and curing expenses.
- Services of a Departmental Tobacco Curer for five years.
- Technical advice and assistance to growers from nursery stage to the marketing of the cured tobacco.

The cigarette manufacturing companies advance the seedlings, fertilizers and materials for barn construction to tobacco growers. The cost of these are recovered in one year at the time of sale of the crop.

The total production of pipe tobacco varied from about 60,000 lb. in 1949-60 to 105,000 lb. in 1952-53 with a sharp decline to 66,000 lb. in 1953-54. This reduction was a direct consequence of the excise tax imposed in July 1953 on leaf tobacco intended to be used for cigarettes and pipe tobacco.

BIDIS

The production of bidis in Ceylon was reported to be 1,75,000 lb. in 1952 or about 15% of the total annual consumption of 1,150,000 lb. From 1953, the average production decreased due to (a) Fixing export quotas for bidi raw materials from India, and (b) The encouragement given to exporters of manufactured bidis by the Government of India and also a possible preference by the bidi trade to imported bidis rather than bidi tobacco and bidi leaf.

Estimated total production of bidis :

Year	Production (in millions)
1948	364
1949	602
1950	698
1951	663
1952	934
1953	354
1954 (for 11 months)	643

Latest figures are not available.

Source :—Report of the Commission on Tobacco Products Industry.

CIGARS AND CHERROOTS

The production of cigars and cheroots in Ceylon is entirely manual, whereas in most of the other countries, machines are used for the manufacture of the same. In 1952-53, the average production of cigars in Ceylon in one establishment averaged 9,64,000 cigars. In 1954-55, the total production from 5-20 factories was estimated at 3-5 million pieces. There are over half a dozen sizes of cigars. During 1954, the production of cheroots on the basis of 250-350 units was about 250-450 million pieces, i.e. an average of 1-2 million pieces per factory. Cheroots are made in about a dozen sizes.

SNUFF AND CHEWING

The production of snuff tobacco was estimated at 40,000 to 80,000 lb. in 1952 and of chewing tobacco between 2 to 3 million lb.

MARKETING

The sale and purchase of leaf in the cigarettes and pipe tobacco industry is entirely by a system of contract entered into between the manufacturers and growers. Between 1951 and 1954, 8 cigarette tobacco growers' societies have been registered. They seek better terms and conditions for growing of leaf tobacco and marketing the crop by collective bargaining. The Commission on Tobacco Products Industry has made a number of recommendations which are expected to ensure effective sale and purchase of tobacco and also to bring basic minimum prices for each grade of leaf tobacco. Cigar, cheroot, snuff, bidi and local chewing tobaccos are disposed off directly by growers, to manufacturers and indirectly through intermediaries acting between manufacturers and growers. The Jaffna Malayalam Tobacco Co-operative Sale Society Ltd. was formed in 1934. After an initial set-back, it has established on a sound footing with nearly 3,000 members. Another society was formed in 1948.

TRADE

Ceylon's trade in tobacco has never been great. Exports of leaf tobacco are composed mostly of Jaffna leaf to South India for use in the manufacture of chewing tobacco. This trade due to quality and price factors increased from 950,398 lb. in 1949 to 1,363,000 lb. in 1950. Combined exports of leaf tobacco and products totalled 1,402,171 lb. in 1950 as against 996,269 lb. in 1949.

The following figures give the quantity exported during the last few years :

Year	Quantity exported (in 000 lb.)
1945-49 (Average)	875
1954	1,784
1955	769
1956	923
1957	1,068

Source :—United States Department of Agriculture.

India consumes a major portion of Ceylon's exports of chewing tobacco. The importable quota of Jaffna tobacco was limited some 20 years ago by the Government of India to 5,745 candies or about 3.45 million lb. Only the erstwhile Travancore Government was permitted to import this tobacco at an import duty of Rs. 135 per candy of 600 lb. Any quantity imported in excess of this was liable to duty at the rate of Rs. 900 per candy. The import duty was thereafter revised to Rs. 300 per candy in 1945. With the integration of the native States into the Indian Union, the Government of India adopted a policy of uniform tariff for all Indian ports and raised the duty on all unmanufactured tobacco imported from foreign countries to Rs. 9.37 per lb. (Rs. 5,625 per candy of 600 lb.).

The Government of India, however, granted a concession in import duty from 1950.

The maximum quota of Jaffna tobacco importable into the old Travancore-Cochin State at a duty of Rs. 300 per candy was fixed at 1,800 candies (1.08 million lb.) for the first year with a reduction in this quota by 10% every year during a period of 10 years at the end of which the duty payable on every candy of Jaffna tobacco would be Rs. 9.37 per lb. This was raised to Rs. 9.84 per lb. later. According to the Indo-Ceylon Trade Agreement concluded in 1953 the Government of India have allowed to import annually a maximum quota of 1.5 million lb. of Jaffna tobacco for the next four years commencing from 1953-54. The import duty on the quantity over and above the allotted quota stipulated by the 1950 agreement, upto a maximum of 1.5 million lb. will be at the rate of Rs. 0.75 per lb.

This agreement was renewed in 1957-58. Under the agreement, *inter alia*, the Government of India will permit the import of Jaffna chewing tobacco during the next four years to the extent indicated below at a concessional rate of import duty of Rs. 400 per candy through the port of Trivandrum.

1957-58	..	1,500 candies
1958-59	..	1,200 candies
1959-60	..	960 candies
1960-61	..	770 candies

The Government of Ceylon will allow the import of beedies from India during the next 4 years to the extent indicated below at the prevailing rate of import duty.

1957-58	..	2.00 million lb.
1958-59	..	1.60 " "
1959-60	..	1.28 " "
1960-61	..	1.024 " "

Exports of Ceylon's chewing tobacco to India during the last 5 years are given below :

	Quantity (in 000 lb.)	Value (in 000 Rs.)
1954	1,233	2,230
1955	727	1,302
1956	864	1,656
1957	690	1,122

In 1958, however, there was no export of Ceylon's chewing tobacco to India.

The imports of unmanufactured tobacco into Ceylon increased from a pre-war average of 1.2 million lb. to 1.5 million lb. in 1948, declined to 0.9 million lb. in 1949 and again rose to 1.5 million lb. in 1950. In recent years import of leaf tobacco have varied round about 2 million lb. Practically all of this was flue-cured leaf from U.S.A. and India. Ceylon imports some quantity of bidi tobacco also from India. The following table gives the imports of unmanufactured tobacco into Ceylon. During the last few years :

Year	Quantity (in 000 lb.)
1945-49	.. 1,831
1954	.. 1,381
1955	.. 1,444
1956	.. 1,788
1957	.. 2,053

Source :—U.S. Department of Agriculture.

Ceylon's imports of unmanufactured tobacco from India consists mostly of flue-cured Virginia. The following table gives the imports of unmanufactured tobacco into Ceylon from India.

Year	Quantity (in 000 lb.)	Value (in 000 Rs.)
1954	504	9,69
1955	424	8,31
1956	309	8,34
1957	765	17,57
1958	206	4,56

With the increase in the domestic manufacture of cigarettes, the imports of these have decreased sharply. About 85 per cent of the imported cigarettes are flue-cured type imported chiefly from U.K. The bulk of the remainder are the popular U.S. brands.

Ceylon imports large quantities of bidis and cigarettes from India. In recent years the major portion of India's exports to Ceylon consists of manufactured tobacco only. The following table gives the exports of manufactured tobacco from India to Ceylon during the last 2 years.

Year	Quantity (in 000 lb.)	Value (in 000 Rs.)
1957	2,519	1,01,35
1958	3,203	1,29,68

Import duties of varying magnitude have been levied on unmanufactured and manufactured tobacco as well as tobacco products with a view to restrict imports and give encouragement to local produce. The rates of import duties are given in Appendix.

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ACKNOWLEDGEMENT

The authors are grateful to Shri A. B. Attygalle, Tobacco Officer, Department of Agriculture, Ceylon, for his help in going through the article and making valuable suggestions.

APPENDIX
STATEMENT OF IMPORT DUTIES WHICH WERE IN FORCE SINCE JANUARY, 1940 ON
MANUFACTURED AND UNMANUFACTURED TOBACCO AND BIDI LEAVES

Date when new rate enforced	CIGARS		SNUFF		BIDIS		MFD. TOBACCO		UNMFD. TOBACCO		BIDI TOBACCO		HOOKAH TOBACCO		Bidi leaves per hundred weight
	Prefl.	Genl.	Prefl.	Genl.	Prefl.	Genl.	Prefl.	Genl.	Prefl.	Genl.	Prefl.	Genl.	Prefl.	Genl.	
	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	
1- 1-40	4.00	4.75	3.00	3.50	4.00	4.75	4.00	4.75	5.00	5.30	2.00	2.30	2.00	2.30	1.50
17- 2-40	6.00	6.75	5.00	5.50	2.50 (Nett)	3.00 (Gross)	6.00	6.75	5.00	5.30	4.00	4.30	4.00	4.30	1.50
10- 4-40	6.00	6.75	5.00	5.50	2.50 (Gross)	3.00 (Gross)	6.00	6.75	3.00	3.30	4.00	4.30	4.00	4.30	1.50
5-11-41	9.00	10.00	5.00	5.50	2.50 (Gross)	3.00 (Gross)	6.00	6.75	3.00	3.30	4.00	4.30	4.00	4.30	1.50
2- 4-42	13.00	14.00	5.00	5.50	2.50 (Gross)	3.00 (Gross)	10.00	10.75	7.00	10.00	4.00	4.30	4.00	4.30	1.50
6-12-43	17.00	18.00	5.00	5.50	2.50 (Gross)	3.00 (Gross)	14.00	14.75	11.00	14.00	4.00	4.30	4.00	4.30	1.50
26-10-45	21.25	22.25	5.00	5.50	4.00	4.50	18.25	19.00	15.25	18.25	4.00	4.30	4.00	4.30	1.50
20- 1-48	60.00	61.00	10.00	10.50	6.00	6.50	30.00	30.75	19.35	22.35	6.00	6.30	6.00	6.30	2.25
24- 9-49	60.00	61.00	10.00	10.50	5.60	6.10	30.00	30.75	20.10	22.35	6.00	6.30	6.00	6.30	5.00 from 13-9-48
19-10-52	60.00	61.00	10.00	10.50	5.60	6.10	30.00	30.75	20.10	22.35	6.00	6.30	6.00	6.30	5.00 from 13-9-48
Surcharge +10%	+10%	+10%	+10%	+10%	+10%	+10%	+10%	+10%	+10%	+10%	+10%	+10%	+10%	+10%	5.00 from 13-9-48
3-11-53	66.00	67.00	11.00	11.50	5.60	6.10	33.00	33.75	20.10	22.35	6.00	6.30	6.00	6.30	5.00 from 13-9-48
Latest available	66.00	67.00	11.00	11.50	5.60	6.10	37.00	37.25	28.10	30.35	3.00	3.30	6.00	6.30	Not available.

(Extracted from the Report of the Commission to enquire into the Tobacco Products Industry in Ceylon and Tobacco World — Annual 1960, London.)

[P.T.O.]

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(a) sold wholesale at not more than Rs. 37-25 per pound nett. ..	31 25	..
(b) sold wholesale at more than Rs. 37-25 per pound nett. ..	32 25	..
3. Manufactured in a country to which preferential rates of duty have been deemed to be applicable from tobacco grown in such country and from foreign tobacco at rates intermediate between (1) and (2) above according to the certified proportion of the leaf content of the tobacco grown in a country to which preferential rates of duty have been deemed to be applicable and a foreign country. ..	..	..
4. Manufactured in foreign countries. ..	..	33 25

CULTIVATION OF
CHEWING TOBACCO IN U. P.

P. S. GUPTA, T. N. SHUKLA and MUNSHI SINGH

(Department of Agriculture, Uttar Pradesh)

Chewing tobacco occupies an important place in the economy of U.P. Uttar Pradesh and Delhi are the most important areas for manufacture of chewing tobacco and account for almost 85% of the total quantity of chewing tobacco manufactured in India (1950-51). Different forms of chewing tobacco are popular viz., Zarda, Kiwam, Dana, Patti, etc.

The important chewing tobacco growing districts of U.P. are Sitapur, Allahabad and Jaunpur. By far the largest area under chewing tobacco is concentrated in Bonabhari and Biswan areas of Sitapur district. Biswan tobacco implies quality chewing tobacco. Because of its value as a cash crop in these districts and very handsome returns it gives to the growers and traders, the method of its cultivation is outlined in the following pages. The details are based on first hand information collected from actual cultivators of the area.

Varieties: The chewing tobacco grown in this area is of *Nicotiana tabacum* type and the following types are recognised by the growers in this locality.

1. **Fadkaha:** Plants are usually 5' to 5½' high with 18" long and 10" to 12" broad leaves. Leaves have minor puckerings; matures in about 3½ months time after transplanting. Yield and quality not very good.

2. **Timraha:** Plant height about 5' leaves of 21" length and 9" breadth. Puckering in leaves present from very early stages. Stem medium in thickness. Matures early. Yield

low, but quality very good. Susceptible to leaf spot diseases; very popularly grown.

3. **Chikanuha:** Plants are 5' to 5½' high with thin leaves without puckering; leaf size 25" long 14" broad. Matures in about 4½ months after transplanting; high yielding but not good in quality as the cured leaves are less bitter. In Biswan area it is known as 'Timraha-lapkana'.

4. **Ghamanda:** Plants about 6' high with 25" long and 14" broad leaves. Matures in about 4½ months time after planting; appears to be disease resistant. High yielding; but quality not very good. In Biswan area it is known as 'Deshi-Katha'.

5. **Purvi:** Plants are 6½' to 7½' high with about 22" long and 14" broad leaf size. Highly puckered leaves with curved midrib. It matures about 4½ months after transplanting.

6. **Ganiraha:** The height of plant 5' to 5½'; leaves are large sized with prominent midrib and pointed apex. Due to abrupt change in breadth, the margins become raised upwards. Not good in yield and quality.

'Timraha' in Bonabhari locality and 'Deshi Katha' in Biswan area are popularly grown. So far no improved variety has been distributed.

SOIL AND CLIMATE

The soil ranges from sandy loam to 'domat' (sandy-clay). The mean temperature ranges

12/4/60

from about 45°F in cold season to 95°F in the hot weather. Frosts often occur in winter but are seldom very severe. The average annual rainfall for the district is 38".

Rotation : The general rotations practised for tobacco are as follows :

1. Fallow — tobacco
2. Maize — tobacco.

The tobacco taken in fallow fields is considered to be of good quality and fetches higher prices.

Nursery : The fields selected for nursery are well prepared and heavily manured. Flat beds usually 6' × 6' or 8' × 8' are prepared for raising nursery. 1 to 1½ 'Chhattak' seed mixed with sand or ash to make it bulky is sprinkled on such beds and it is made compact by pressing with hand. They keep the higher seed rate to be absolutely certain for good germination. The nursery is sown in July or latest by 1st week of August. For quick growth, Ammonium sulphate (one oz. in one gallon of water) is applied to the nursery after about three weeks of sowing. Weeding is done as and when required.

Preparatory tillage and Manuring : Preparation of fields for transplanting starts as soon as the fields become free of previous crop. Hot weather cultivation is invariably done. About 10 to 15 ploughings with Deshi plough are given. Traces of weeds etc. are removed from the fields. The fields are very heavily manured, about 50 to 60 cart-load f.y.m./acre. There is a general practice of applying hornscrap as a manure in this area, with the belief that by the application of hornscrap the quantity and quality are improved. About 8 to 10 mds. of hornscrap per acre is applied. 'Lona mitti' from the ruins of old buildings is also applied as a manure. Usually 3-4 cart-loads of 'lona mitti' is applied per acre. This quantity varies according to its availability.

Transplanting : After a thorough preparation, transplanting is done at a distance of 16" to 18" each way with the help of 'Khurpi' by opening a slit and putting one healthy seedling in one hole. The transplanting period ranges from 'Kwar' (Sept.-Oct.) to 'Kartik' (Oct.-Nov.). About two cents of nursery will provide seedlings for transplanting an acre. Usually the seedlings are taken out in three pullings from one nursery. After the transplanting a light flood irrigation is given immediately.

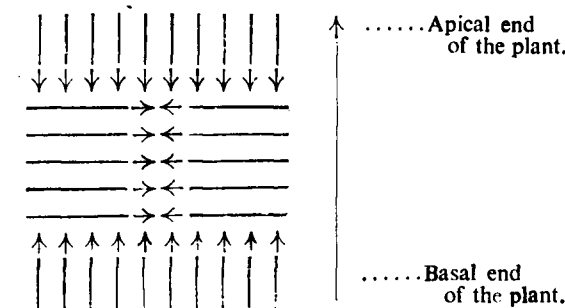
Irrigation and cultural operations : The usual source of irrigation is canal or well water. As far as possible water of sweet wells is used for the irrigation of tobacco. Normally 3 to 4 irrigations are given during the whole cropping season, as the cultivators believe that a crop with profuse vegetative growth is poor in quality and so they give less irrigations and try to get quality at the cost of quantity. Weeding and hoeing is done as and when required.

Topping and Suckering : Topping is done at 8 to 10 leaf stage about 45 days after transplanting. The sand leaves are also removed. After topping suckers develop which are removed from time to time to get high yield and good quality. Usually 5 to 6 suckering are done in the whole cropping season.

Harvesting : Harvesting is done during January-February, after about 3½ to 4 months of transplanting. The period of maturity varies according to variety grown. Whole plants are cut at the ground level with the help of a 'Khurpi'.

Curing : The harvested whole plants are spread separately in the morning and collected in small heaps in the evening, to avoid wetting of plants by dew. The process is continued till there is a complete drying of leaf lamina. The size of heaps increases as the plants get partly dry. It takes about 20 to 25 days for

the complete drying of leaf lamina. This process is essentially a whole plant curing process. The next stage is to keep the tobacco in a 'ganj' (heap) to bring it into condition. The method of keeping this partly cured tobacco in 'ganj' is given below :—



The usual size of 'ganj' is 5' to 6' long 3' to 4' broad and about 5' high depending on the amount of tobacco available with the cultivator in a particular field. The 'Ganj' is always kept covered with a straw cover, keeping the sides uncovered. After three days the 'ganj' is turned over and reheaped and thus the upper plants go to the lower level and the lower ones to upper level. About 2 to 3 such turnings are given to this type of heap. After about one week it is spread in the sun for drying, and the tobacco remains in the sun for 3 to 4 days. The plants are completely dried and carried to godowns. Before the tobacco is kept in final 'ganj' slight sprinkling of water is given. This water is the extract of waste tobacco leaves. The 'ganj' is completely covered by cloth or gunny bags to protect against wind and light. The process of heaping and reheaping is continued till the desired colour (dark brown) is obtained. After this the leaves are separated from the stalk with a portion of stalk at the petiole end. Six to seven leaves are tied together which are locally known as 'Garias' (hanks). After this the tobacco is stored.

Yield : It varies from cultivator to cultivator depending on the variety, manure ap-

plied and the amount of care taken for timely operations by the grower. The yield of cured leaves varies from 15 to 25 mds. per acre in case of Timraha, and Deshi Katha varieties respectively. The yield of stalk ranges from 1/8 to 1/5 of the yield of cured leaves.

Economics of cultivation of the crop : To know the profit and loss figures in connection with the cultivation of chewing tobacco the following information was collected from cultivators. This is based on the memory of the growers and so is liable to variation.

S No.	Particulars	Amount
		Rs.
1.	Land rent	.. 50.00
2.	Preparation of fields—	
	(i) Ploughing (10)	.. 60.00
	(ii) Manuring—	
	F.Y.M.	.. 100.00
	Hornscrap or Ground-	
	nut cake	.. 45.00
	Amm. Sulphate	.. 38.00
	'lona mitti'	.. 20.00
3.	Nursery preparation	.. 20.00
4.	Transplanting	.. 12.00
5.	Irrigation (canal water)	.. 60.00
6.	Hoeing and weeding	.. 25.00
7.	Topping and suckering	.. 75.00
8.	Harvesting	.. 7.50
9.	Curing	.. 50.00
10.	Miscellaneous	.. 12.50
	Total per acre	.. 575.00
Profit or loss : When variety Timraha is used, the yield of cured leaves per acre—		
	= 15 mds. @ Rs. 75/md.	Rs. 1,125.00
Stalk per acre—		
	= 2 mds. @ Rs. 10/md.	Rs. 20.00
	Total	Rs. 1,145.00

	Rs.	Though there is a difference of 10 mds. (25 — 15) in the yields of Timraha and Deshi Katha varieties the difference in net profit is not significant because the quality of Timraha is superior and quality determines price per maund.
Gross profit	.. 1,145.00	
Total Expenditure	.. 575.00	
Net profit	.. 570.00	
When variety Desi Katha is used the yield of cured leaves per acre—		
= 25 mds. @ Rs. 45/md.	Rs. 1,125.00	
Stalk per acre—		
= 5 mds. @ Rs. 10/md.	Rs. 50.00	
Total	Rs. 1,175.00	It will be seen from the economics given above that the cultivation of chewing tobacco is an economical proposition in U.P. The Department of Agriculture has recently started work on the improvement of this tobacco in collaboration with the Indian Central Tobacco Committee and it is expected that before long improved methods of its cultivation and new varieties will be available to the cultivators.
	Rs.	
Gross return	.. 1,175.00	
Total expenditure	.. 575.00	
Net return	.. 600.00	

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EFFECT OF PLACEMENT OF MANURE ON BIDI TOBACCO CROP*

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INTRODUCTION

Previous experiments on manuring of bidi tobacco have shown that with increase in nitrogen application there is an increase in tobacco yield upto 240 lb. N per acre, the optimum economical level of manuring being 160 lb. N. as reported by Patel and Patel (1959). These experiments were carried out by broadcasting the groundnut cake and ploughing it under with a wooden plough to supply calculated quantities of nitrogen, as broadcasting is the general procedure of manure application for bidi tobacco crop in Gujarat. This practice appears to be very sound because the crop is liberally manured with groundnut cake and as a result band or furrow application of this manure is likely to result in poor stand of the crop due to root injury.

However, the disadvantages of the method cannot be overlooked as, because of the nature of the manure recommended and the weather conditions prevailing during the tobacco season in the tract, the manure has to be applied 15-20 days prior to transplanting. Hence, loss of manure due to washing off of soil is very likely, both prior to and after transplanting. Moreover, the manure is spread all over the area and there is too much time-lag between the manure application and the spreading of the root system all over the area. Hence, leachate losses are also very likely.

Under the present system of tobacco cultivation, interculturing after transplanting in particular, the upper 3"-4" of soil becomes completely dry about 4 weeks after transplanting and is completely devoid of the active root system. Thus leaving aside the losses due to leaching, it is possible that the entire quantity of manure may not be available to the plants.

Bidi tobacco is largely grown in India and very little work seems to have been done on the placement of manure for this crop. Gardner (1951) has stated that fertilizer application should be done taking into consideration the type of soil and the quantity of manure to be applied because generally tobacco soils have low water-holding capacity and soluble fertilizer materials placed close to the plant roots may seriously injure them. In practice, application of fertilizer at rates of a ton or more per acre usually is made by broadcasting to avoid the root injury. He has recommended that for fire cured tobacco, where the rate of fertilization is very light and the plants are widely spaced, the fertilizer may be placed under the individual plants. He has further stated that mixing the fertilizer well with the soil of the row will avoid the injury to the plants and increase the efficiency of the fertilizer.

Macmurtrey (1935), Swanback and Anderson (1944), Swanback (1947) and others working on various types of tobacco have

* Paper read at the Second Conference of Tobacco Research Workers in India held at Anand on 17-12-59 and 18-12-59.

Effect of Placement of Manure on Bidi Tobacco Crop

reported that band application is advantageous to the broadcasting method, if root injury to the plants could be avoided.

Chheda (1956) working on bidi tobacco has reported that broadcasting the fertilizer before transplanting was superior to placements both in yielding capacity and quality of the final produce.

Practically no information being available on the placement of manure for bidi tobacco crop at the time of starting this experiment, it was very worthwhile to study the effect of placement of groundnut cake as a manure for bidi tobacco crop.

MATERIALS AND METHODS

With the object of studying the effect of placement of groundnut cake as a manure for bidi tobacco, this experiment was undertaken and the treatments were the combinations of the following :—

A. Method of application of manure (P) :

- (1) Drilling (2"-3" deep)
- (2) Plough-drilling (4"-5" deep)
- (3) 50 : 50 drilling and plough-drilling.

B. N. levels (N) :

120, 160 and 200 lbs. N. per acre.

The control was 160 lbs. N from groundnut cake broadcasted and ploughed under 15-20 days before transplanting.

The experiment was conducted during 1955-56 to 1958-59 and the field arrangement was a randomised block design with six replications. As regards the methods of application, drilling (2"-3" deep) was done with a seed-drill, while plough-drilling was done with a plough prepared for deep sowing purposes. The 50 : 50 drilling and plough-drilling was done firstly by plough-drilling and then drilling. The treatment 160 lbs. N. in the form of groundnut cake broadcasted and ploughed under was the control.

Deoiled groundnut cake was used as a manure during the course of investigation.

SEASONS AND CULTURAL DETAILS

The tobacco crop in the experiment was grown according to the general practice of bidi tobacco cultivation in Gujarat except for the differences in manure application. The crop was spaced 3' x 3' and the plants were topped keeping 11 good leaves after removing 3-4 bottom leaves. The crop thereafter was regularly suckered at weekly intervals.

The experiment was conducted during 1955-56 to 1958-59 (inclusive) and the seasons were very much different which becomes evident from the distribution of the rainfall data in relation to the manure application and transplanting operations presented in Table 1.

TABLE 1. Distribution of rainfall in inches before and after transplanting and between manuring and transplanting operations.

Period	1955-56	1956-57	1957-58	1958-59
Season's total	30.99	48.72	22.54	36.43
Before transplanting	14.74	40.82	20.71	14.42
After transplanting	16.25	7.90	1.83	22.01
Between manuring and transplanting	10.57	2.09	3.58	3.69

Thus, about 26.82, 9.99, 5.41 and 25.70 inches of rain was received after manure application during 1955-56, 1956-57, 1957-58 and 1958-59, respectively. Further, during 1955-56 the effective rains had started in the first week of August instead of June end or July beginning and even though the August rains were very favourable for transplanting, gap-filling had to be done very frequently because of the continuous rains. The development and maturity of the crop were satisfactory.

During 1956-57, the crop had to be transplanted on irrigation in spite of 40.82" rain before transplanting. Though only 7.90 inches of rain was received after transplanting about 5" rain received during second week of October was very damaging. However, the development and maturity of the crop during that season were fair.

In 1957-58, the rainfall was very scanty. Though the crop was transplanted on rain, it had to be irrigated four times and gaps filled with every irrigation. As a result, the plant stand was not much vitiated, but the uniformity of the crop was lost. Yet the development and maturity of the crop were satisfactory.

Among all the seasons, the 1958-59 season was normal for bidi tobacco crop in Gujarat and the crop development and maturity were also normal.

METHODS OF MAKING MEASUREMENTS

Data on all the characters were collected on competitive plants in net plots. The following characters were studied during the course of investigation.

Plant establishment : The dead hills were counted after about a week of transplanting.

Topping of plants : When the plants had developed about 14-15 leaves, the top of the plant was removed leaving 11 good leaves after removing 3-4 bottom leaves.

Leaf length and width : A random sample of five consecutive plants in a row was selected for the purpose in each net plot. Leaf length was measured in centimeters from the leaf axil to the leaf tip and maximum width on the leaf was measured as leaf width.

Leaf area : Top five leaves of the mature sample plants selected for growth measurements were measured for leaf area in square inches.

Spangle development : The spangles are the red rusty spots that develop on the leaves on maturity. For the top five leaves of the sample plants spangle marks were assigned on the basis indicated below :

No spangle development	0 mark
Upto 25% area developing spangles	1 mark
26 to 50% area developing spangles	2 marks
51 to 75% area developing spangles	3 marks
above 76% area developing spangles	4 marks

Earliness : For assessing this character, proportion of the first harvest produce as per cent of the total produce was utilized as the criterion.

Yield : The saleable form of the produce is composed of "Bhuka", "Geran", "Galia" and "Lakda". These fractions were weighed separately in lb. for each plot.

Valuation : Evaluation of the treatment samples each year was made by a panel of merchants and average valuation worked out.

METHOD OF STATISTICAL ANALYSIS

The data (including control) of individual years were statistically analysed following the appropriate form of analysis. The data combined over years were analysed adopting the form of analysis of variance given in Table 2.

TABLE 2. Form of analysis of variance for the data (including control) combined over years.

Source of variation	D.F.	M.S.	E.M.S.
Years	(y-1)		
Replications	(r-1)		
Years × Replications	(y-1)(r-1)		
Treatments	(t-1)	M_1	$\sigma e^2 + r\sigma ty^2 + ryK^2$
Treatments × Years	(t-1)(y-1)	M_2	$\sigma e^2 + r\sigma ty^2$
Error	y(t-1)(r-1)	M_3	σe^2

Where r = Number of replications.

t = Number of treatments.

y = Number of years.

 σe^2 = Error variance arising from plot to plot variation. σty^2 = Variance due to Year × Treatment interaction. K^2 = Component arising from the fixed effects of treatments.

TABLE 3. Form of analysis of variance for the data (control excluded) combined over years.

Source of variation	D.F.	M.S.	E.M.S.
Years	(y-1)		
Replications	(r-1)		
Years × Replications	(y-1)(r-1)		
Methods	(p-1)	M_1	$\sigma e^2 + r\sigma npy^2 + rn\sigma py^2 + rnyK_1^2$
N. levels	(n-1)	M_2	$\sigma e^2 + r\sigma^2 npy + rp\sigma^2 ny + rpyK_2^2$
Methods × N. levels	(p-1)(n-1)	M_3	$\sigma^2 e + r\sigma^2 npy + ryK_3^2$
Methods × Years	(p-1)(y-1)	M_4	$\sigma^2 e + rn\sigma^2 py$
N. levels × Years	(n-1)(y-1)	M_5	$\sigma^2 e + rp\sigma^2 ny$
N. levels × Methods × Years	(n-1)(p-1)(y-1)	M_6	$\sigma^2 e + r\sigma^2 npy$
Error	y(pn-1)(r-1)	M_7	$\sigma^2 e$

Where y, r and $\sigma^2 e$ have the same meaning as stated in table 1.

p = Number of methods of application.

n = Number of N. levels.

 $\sigma^2 npy$ = Nitrogen × Method × Year interaction variance component. $\sigma^2 ny$ = Nitrogen × Year interaction variance component. $\sigma^2 py$ = Methods × Year interaction variance component. K_1^2 , K_2^2 and K_3^2 are components due to the fixed effects of methods, N. levels and Methods × N. levels, respectively.

To test the significances of the methods of application, N. levels and their interaction the data excluding the control were also analysed. The form of analysis of variance is given in Table 3.

RESULTS

During the course of investigation, the seasons were very much different from one another and these have been assumed to be a random sample of the seasons to come in future. The results of 1957-58 have been completely omitted because of the inexplicable nature of the performance of the treatments, particularly a negative "b" value when the data were subjected to covariance analysis. Probably this could have resulted from the crop having been taken on irrigation and uneven plant stand and late plants having got harvested together with the normal ones. Each year, the data were collected on important agronomical characters some of which have been reported in this article. The results on establishment and growth characters are summarised in Table 4.

Plant establishment: After the setting of the crop, the first important character to be studied is the effect of the treatments on the plant establishment. In this respect, though the treatment differences were not very wide, there was a general trend that plant establishment was comparatively more in broadcasting method than the remaining methods. The placement methods in respect of their effect on plant establishment were in the following descending order. (1) 50 : 50 drilling and ploughing, (2) drilling, and (3) plough-drilling.

Topping of plants: Bidi tobacco plants are generally topped when the plants develop about 14-15 leaves. In this experiment, the plants were topped leaving 11 leaves after removal of 3-4 bottom leaves. As the plants that grow faster will reach to topping stage

earlier, the topping counts (number of plants topped at each topping round) indicate the rate of growth in the treatments under study. Depending upon the season, topping of the experimental plants was completed in 5-10 toppings with majority of plants getting topped in about 5 toppings. Because of the variable number of topping rounds in each year, the data of first five toppings have been combined and reported in Table 4.

On an average, about 75 per cent of plants were topped during 5 topping rounds and there was increase in plants topped with increase in nitrogen application. Comparatively, more number of plants were topped in control (broadcast method) than in other methods of application of manure.

Leaf length and width: As leaf size is directly related to yield, all the leaves of each of the five consecutive plants selected at random in 1955-56 and 1956-57 were measured at about fortnightly intervals. However, the results of top five leaves only are reported in Table 4.

There was not much difference in the final leaf length and breadth with respect to placement methods and N. levels. The 50 : 50 drilling and plough-drilling method, and 200 lb. N. level had the maximum length and breadth development.

Only the final length-breadth data for 1955-56 and 1956-57 were statistically analysed and the results were significant during 1955-56 only. The effects of treatments, nitrogen, and nitrogen × placement were significant whereas the effects of placement methods were not significant.

Leaf area: The leaf area was measured in sq. inch on an above the length width measurements. The results in Table 4 are very suggestive of the effect of the treatments on leaf yield which is directly related to leaf area. Among the methods, 50 : 50 drilling and

TABLE 4. Developmental plant characters as influenced by the methods of placement of manure and nitrogen levels.
(Data combined for first two years only).

Character studied	Placement of manure			Nitrogen levels			Control (160 lb. N. p.a. broadcast)
	Drilling	Plough- drilling	50:50 drilling and plough- drilling	120 lb.	160 lb.	200 lb.	
No of dead hills	0.69	1.04	0.66	0.74	0.85	0.80	0.11
Percentage plants topped:							
1st topping	5.3	1.8	5.4	4.5	3.2	4.8	12.2
2nd "	19.0	12.4	19.6	16.3	17.2	17.5	23.3
3rd "	21.2	21.8	21.7	19.0	21.3	23.4	20.6
4th "	14.2	17.1	14.8	14.2	16.6	15.4	16.7
5th "	13.3	16.5	13.4	13.8	14.8	14.5	11.5
Total	73.0	69.6	74.9	67.8	73.1	75.6	84.3
Leaf length (cm):							
1st measurement	56.32	58.65	59.61	57.84	57.87	60.87	59.03
2nd "	59.87	60.66	61.41	59.80	59.39	62.74	60.43
3rd "	61.06	61.85	62.40	61.07	60.59	63.66	61.34
Leaf width (cm):							
1st measurement	26.82	27.67	27.96	26.77	27.02	28.66	27.29
2nd "	28.07	29.19	29.33	28.17	28.44	29.99	28.41
3rd "	29.41	30.53	30.69	29.54	29.77	31.32	29.43
Leaf area (sq. inch)	174.4	181.7	185.5	173.5	174.1	194.0	174.3
Earliness (% produce harvested in 1st harvest)	17.1	14.9	16.4	14.8	15.6	18.0	16.5
Spangle development (marks)	1.85	1.87	1.87	1.79	1.81	1.99	1.80

plough-drilling had highest leaf area, second to it being plough-drilling alone and there being practically no difference between the drilling and the broadcast methods. With regard to N. levels, there was increase in leaf area with increase in nitrogen application. The area results were significant for nitrogen, and placement $\times$ nitrogen interaction ($P \times N$) during 1955-56 and for $P \times N$ alone during 1956-57.

Earliness: There was very little difference in crop maturity as judged from the percentage produce received in the first harvest indicating that the crop having low rate of growth initially in the placement methods as compared to the control (broadcast method) makes up the growth finally and the crop maturity is not affected. With respect to N. levels, the trend was as expected but the differences were not wide.

Spangle development: The top five leaves of the sample plants were evaluated for spangle development, the results of which are reported in Table 4.

The results reveal that there was practically no difference in the spangle marks on the basis of two years' averages. This shows that the crop that was slow in development initially in some of the treatments not only made up the growth but also finally matured normally, rather as good as the crop having good early start. The results of the individual years were statistically analysed and the effects of nitrogen and the interaction $P \times N$ were significant during 1956-57 only.

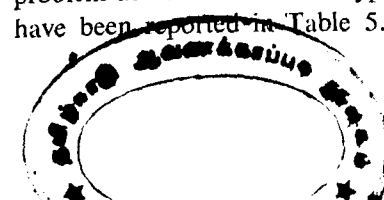
Yield: The most important agronomical character of commercial importance is the yield of tobacco. This comprises four fractions viz., "Bhuka" (lamina pieces), "Geran" (lamina pieces adhering to the midribs at the time of lamina collection, veins and tip portion of midribs), "Galia" (sand leaves devoid of midribs), and "Lakda"

(midribs). Under the present marketing practices each fraction is sold at the same rate and hence the total produce made up of all the above fractions was analysed statistically for individual years' data as well as data combined over years. The results have been reported in Table 5.

The differences in yield due to methods of application and N. levels were significant for the three years' data reported in Table 5. With respect to the methods of application, there was no consistency in significance of one method over the other although 50:50 drilling and plough-drilling yielded the highest every year. When the performance of the control (160 lb. N. broadcast) is compared with other placement methods, it is generally found close to the drilling method. Thus obviously, 50:50 drilling and plough-drilling could be said to be better than the broadcast method also. Individual comparisons of the treatments are not made here but when the data with control included were analysed statistically, the treatment effects were significant in all the three years and the treatment 160 lb. N., 50% drilled and 50% plough-drilled, was significantly superior to the 160 lb. N. broadcast (control) in 1955-56 and 1958-59.

With respect to N. levels, the increase in yield of tobacco for each N. level was significant during 1955-56 and 1956-57 whereas in 1958-59, the difference between 120 and 200 lb. N. only was significant. The interaction between the methods of application and N. levels was not significant in any of the years of study.

Valuation: The treatment samples of final produce ("Bhuka" only) were got evaluated by a panel of merchants each year to get a rough estimate of quality because quality determination in bidi tobacco has still remained a problem as in other tobacco types. The results have been reported in Table 5.



Effect of Placement of Manure on Bidi Tobacco Crop

The differences in the mean valuations of hence the produce could be considered almost various levels of factors were negligible and of the same quality.

TABLE 5. Effects of placement of manure and nitrogen levels on yield in lb. per acre and valuation of bidi tobacco.

Year	Methods of application			Nitrogen levels			Control
	Drilling (D')	Plough drilling (P')	50:50 drilling & plough- drilling (D/P')	120 lb. (N ₁)	160 lb. (N ₂)	200 lb. (N ₃)	(160 lb. N. broadcast)
1955-56	*1331	1415	1422	1265	1422	1481	1310
1956-57	1680	1701	1754	1654	1691	1770	1695
1958-59	1334	1463	1469	1377	1412	1478	1276
Years combined	1474	1557	1582	1469	1537	1607	1463
Valuation in Rs. per 41 lb. of produce	25.32	24.69	24.76	24.28	25.65	24.85	23.59

* Significances are based on L.S.D. tests.

DISCUSSION

The results presented in Table 4 reveal that though the differences in the number of dead hills after a week of transplanting were not much, there was an indication of increase in plant deaths with increase in depth of manuring, the plough-drilling method having the highest and the broadcast the lowest. This suggests that if the nutrients are available in the vicinity of the new roots formed by the transplants, establishment of the crop will be better. Hence, proper placement of the manure is very important to have an uniform crop with perfect plant stand.

The results on topping studies confirm the findings on the plant establishment. The control had the highest percentage of plants topped in first five toppings. This happens probably because when the manure is applied by broadcast method, the plant nutrients become available to the plants immediately on the formation of new roots and the plants in these treatments receive a minimum shock of transplanting. This means a quick start and good early growth. The topping data presented graphically in Figure 1 and those reported in Table 4 show that the crop development in early stages was delayed with increase in depth of manuring, the plough-drilling method hav-

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ing on an average the lowest percentage of plants in the first topping round as well as in the total of five rounds. Although, the three curves of the placement methods have the same peaks, the initial start and the slopes indicating the rates of growth are different. The curve for control (broadcast method) has a different peak and a much higher starting point than the plough-drilling method. In general, the curves for drilling, and 50 : 50 drilling and plough-drilling methods fall between the curves of the broadcast (control) and plough-drilling methods. The effects of N. levels were as could be expected on the basis of plant nutrient supply in the treatment plots within the limits of crop tolerance. Though linearity of the response is doubtful because of the unequal increases between 160 and 120, and 200 and 160 lb. N. per acre, the results do show that bidi

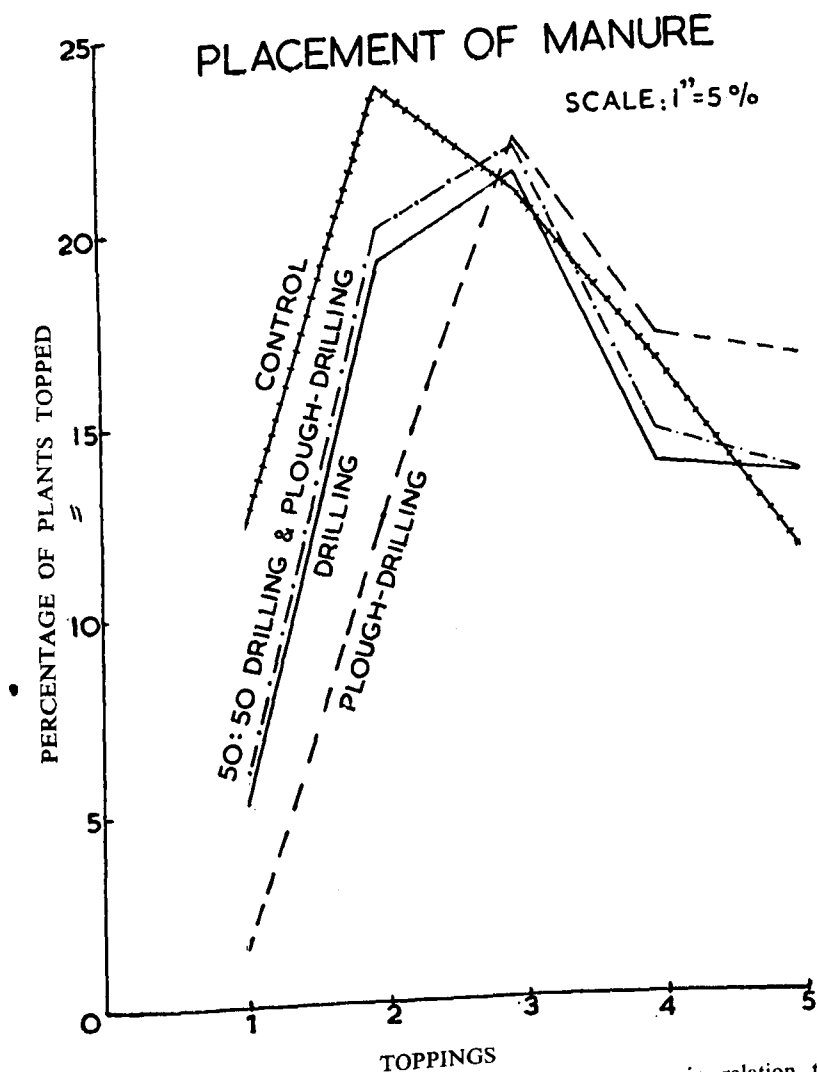


Figure 1. Growth developments of bidi tobacco crop in relation to methods of application of manures at varying levels of nitrogen.

tobacco crop in Gujarat responds even upto 200 lb. N., the highest limit being unknown. These results are in accordance with the results reported by Patel and Patel (1959) that though 160 lb. N. is the optimum economical level of manuring bidi tobacco in Gujarat, the crop has responded even upto 240 lb. N. per acre.

The development of the leaf as judged from the leaf length and width measurements was not influenced much by methods of application as well as N. levels. However, the average initial as well as final leaf length and width measurements were more for 50 : 50 drilling and plough-drilling method, and 200 lb. N. level. Thus the results show that the lower growth rate in the placement methods (other than control) as indicated by topping count, was made up later on in these methods, particularly in the plough-drilling method. This probably happens because of the availability of the plant nutrients in deeper layers on account of the placement treatments and plants growing faster when the feeder roots cover up that strata. While in case of the broadcast method, the plant development gets checked because majority of the manure is confined to upper surface where the plant nutrients are likely to get locked up because of the intercultural practice and lack of adequate moisture in that strata as bidi tobacco crop in Gujarat is generally a rainfed crop.

The results of leaf area are in accordance with the length-breadth results, the leaf area in 50 : 50 drilling and plough-drilling method, and 200 lb. N. per acre being the highest for methods and N. levels, respectively. The leaf on an average in 50 : 50 drilling and plough-drilling method was about 6.7% larger than in the broadcast method (control), which means that the fertilizer efficiency increases by this method of manure application in comparison to the method commonly followed by growers.

The results of the spangle development and earliness (as judged from the percentage produce harvested in first harvest) show that there was no appreciable differential effect of the methods on these characters. These results also confirm that the crop in the placement methods makes up the growth in spite of low initial growth rate, for the reasons advanced for leaf area results. As regards the N. levels, there was progressive increase in percentage produce received in first harvest and spangle development with increase in nitrogen application. These results are in accordance with those reported by Patel and Patel (1959).

Yield of cured leaf is commercially the most important agronomical character. During all the three years, the trend in yield was the same both for methods and N. levels, significances among the methods of applications and N. levels being a matter of seasons. In two out of three years, the plough-drilling, and drilling and plough-drilling methods yielded significantly more tobacco than the drilling method. The results, whether significantly different or not, have been in favour of 50 : 50 drilling and plough-drilling method during all the years of study. In general, all the three placement methods have more or less performed better than the broadcast method. The combined analysis of the data after testing homogeneity of variances by Bartlett's test showed that none of the interaction effects was significant, indicating that the effects of placement methods and N. levels were not influenced by the variable environments in which the study was made. Thus, for efficient usage of manures, it is desirable if the manure is applied in the strata between 2" to 5" depth.

In the absence of a treatment combination of placement of part of the manure in 2"-5" depth and part as broadcast, a logical inference could be drawn from these results that such a combination is likely to be even more advantageous than any of the placement method

tried in this study because the fraction broadcasted will give initial start to the crop and the fraction placed between 2" to 5" depth will not only keep up the initial start of the crop but also will accelerate it and finally result in increased yields. The logical deductions will be tested experimentally in coming years.

The progressive increase in yield with increase in nitrogen application is in confirmation of the results reported by Patel and Patel (1959). The finer economics of these however have not been worked out because the principal object of the experiment was to study the efficiency of the methods of application of manure at varying N. levels.

The results on valuation of the treatment samples did not show any differential effect of the methods of application as well as N. levels on quality of the produce.

SUMMARY

Manuring of bidi tobacco in Gujarat is generally done by broadcasting the manure (mostly oil cakes). The intent of this experiment was to study whether the efficiency of the manure could be increased by applying it deep.

Following conclusions have been reached from the results of the study :

- (1) The initial development of the plants in broadcast method is more than that in the other methods of manure placement, viz. (a) drilling (2"-3" deep), (b) plough-drilling (4"-5" deep), and (c) 50 : 50 drilling and plough-drilling.
- (2) The development of the plant after topping is more in the placement methods than the broadcast method and the crop makes up the initial low rate of development and gives increased yields.
- (3) The manure for bidi tobacco crop when applied by plough-drilling and drilling, or plough-drilling method is found to be more efficient in compa-

risson to the general method of broadcasting the manure.

- (4) The placement methods studied do not have any differential effect on the quality of the produce.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. M. D. Patel, Director, Institute of Agriculture, Anand for his keen interest in the work and providing facilities for successful completion of the project. The authors also wish to thank Dr. R. M. Patel, Principal, Extension Training Centre, Institute of Agriculture, Anand for suggestions in the preparation of the manuscript and Shri M. N. Naik, former Junior Research Assistant, Bidi Tobacco Research Scheme for help in collection and statistical analysis of data in 1956-57.

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PREPARATORY TILLAGE STUDIES IN FLUE-CURED TOBACCO *

G. C. PATEL,¹ N. A. AWATRAMANI²
and D. V. V. PRASAD³

INTRODUCTION

Preparation of the soil to bring it into the best tilth is of prime importance for successful raising of any crop. In row crops like tobacco, this not only provides a congenial rooting medium for the young seedlings to make a good start but also lessens the amount of cultivation during the growth period of the crop. Since the optimum preparatory tillage necessary for different crops would vary with the type of soil and the climate, such studies need to be conducted specifically for each crop under the soil and climatic conditions obtained in a tract.

Flue-cured tobacco in Andhra Pradesh is raised on black cotton soil containing about 60% clay, mostly on conserved moisture. More than 75% of the rain is received prior to planting which usually commences late in October. Because of heavy rainfall during this period and the soils being clayey, scope for preparatory tillage operations is limited and confined to few intermittent short dry spells. Tobacco growers in the tract, however, give as many as six ploughings with country plough and two harrowings as preparatory cultivation. The results of an experiment at Guntur during 1953-54 and 1954-55 indicated, that five tillage operations were enough. Though the soils at Guntur are not much different from those at Rajahmundry, there is variation in the

total rainfall and its distribution. Therefore, studies on preparatory tillage were started at the Central Tobacco Research Institute, Rajahmundry during 1955-56. The results obtained thus far from various experiments are presented in this paper.

REVIEW OF LITERATURE

Early work on these aspects by Cates and Cox (1912) revealed that cultivation is not beneficial to corn except in removing the weeds. Merkle and Irwin (1931) found no significant differences in yield of potato or corn between scraping, 3 cultivations and 6-8 cultivations. Neither biological activity as shown by nitrate production nor soil moisture was increased by cultivation. Thompson *et al* (1931) obtained high potato yields with 4 to 6 cultivations as with 7 to 9. Scraped or non-cultivated plots gave significantly higher yields than either. Khan (1957) working with soil containing 31% clay at Indian Agricultural Research Institute, New Delhi showed that variation in frequency of cultivation did not affect the yield of maize crop. The deficiency in tillage for seed bed preparation could be made up by subsequent hoeing during the life cycle of the crop.

Studies by Gilmore (1955) on tobacco grown in sandy soils of Canada showed, that where weeds were a problem 2 to 3 cultiva-

* Paper read at the Second Conference of Tobacco Research Workers in India held at Anand on 17-12-59 and 18-12-59.

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tions were necessary but otherwise cultivation had little effect on yield or acre returns. Wilson (1955) working on three different types of soils found that neither scraping nor deep cultivation improved the tobacco growth over shallow cultivation.

PRELIMINARY WORK

A preliminary trial was laid out in randomised block design with 4 replications during 1955-56. The treatments were as follows :

- A. Ploughing 12 times with mould board plough.
B. Ploughing 5 times with country plough.

C. Unploughed till October, followed by 2 ploughings with country plough.

D. Cultivation with planet junior hoe during monsoon and 2 ploughings with country plough later.

(The treatments in this experiment were modified during 1956-57 and hence the results of their performance has not been discussed here.)

The data on the effect of various treatments on the yield and quality of flue-cured tobacco are presented in Table I.

TABLE I. Effect of method of preparatory cultivation, on the yield and quality of cigarette tobacco.

Treatments	Yield in kilograms per acre			
	Green leaf	Cured leaf	Bright leaf	Total Bright Leaf Equivalent
A. Ploughing 12 times with iron mould board plough. ..	1764	338	117	171
B. Ploughing 5 times with country plough. ..	2204	419	164	227
C. Unploughed till October followed by 2 ploughings with country plough.	2462	457	180	249
D. Cultivation with planet junior hoe during monsoon and two ploughings with country plough later. . .	2575	466	158	234
Mean ..	2251	420	151	220
C.D. at 5% ..	223	62	49	50
Significance ..	<u>DC</u> <u>BA</u>	DCB A	<u>CBD</u> <u>A</u>	<u>CDB</u> <u>A</u>

The results broadly indicate that :

- (i) Very frequent preparatory tillage (12 ploughings with mould board plough) was detrimental from both yield and quality point of view. Five tillage operations with country plough gave good results confirming the findings at Guntur reported previously.
- (ii) Either no cultivation or shallow cultivation during monsoon (treatments C and D) gave as high yields as, or even slightly better, than five operations with country plough.

The ancillary data recorded on stalk weight and flowering indicated that stalk development was significantly poorer in treatment A and the crop tended to be late as compared to the rest of the treatments.

Treatments	Ploughings with mould board plough	Ploughings with country plough	Harrowings
A	0	3	2
B	1	2	2
C	2	1	2
D	0	0	5
E	0	1	4
F	1	1	3
G	2	0	3
H	0	2	3
I	1	0	4
J (Control)	0	6	2

MATERIAL AND METHODS

In light of the preliminary work, a systematic experiment was laid out in 1957-58 mainly to find out the optimum combination of 5 tillage operations in the form of ploughings with mould board or country plough and harrowings from standpoint of yield and quality. The farmers' practice of preparatory tillage (six ploughings and two harrowings) was included as a control treatment. The lay out was randomised block design with 4 replications. The net plot size was 2.2 cents. The experiment was continued at the same site during 1958-59 season.

In treatments with ploughing operations, one ploughing was given soon after the advent of monsoon. The second ploughing was reserved for final preparation of the field at planting. Wherever third ploughing was required to be given, it was given during the break in the mid-monsoon season. Similarly, harrow-

ings were also spread out depending upon the number of operations reserving one for final field preparation.

The crop received a basal manuring with farmyard manure at 3 tons per acre and 20 lb. N per acre in the form of ammonium sulphate. The variety Harrison Special was planted with 33" spacing both ways. Planting was done on 28th October, in 1957-58 and on 13th November, in 1958-59. Two interculturings with planet junior hoe at an interval of about 20 days after planting were given to the crop. A final interculture was given with a country plough 15 days after the second interculture.

SEASON

Rainfall data according to crop periods for 1957-58 and 1958-59, during which years the experiment was conducted are presented in Table II. Detailed data of pre-nursery and nursery periods have also been given.

TABLE II. Rainfall in millimeters and number of rainy days according to crop periods.

Crop periods ending in Meteorological weeks	1957-58		1958-59		Normal *	
	Rain fall	No. of rainy days	Rain fall	No. of rainy days	Rain fall	No. of rainy days
1. Hot weather.						
April 2nd-3rd June ..	27.8	3	104.2	7	126.1	11
2. Pre-nursery.						
June 4th-10th ..	4.3	1	—	—	11.9	1
June 11th-17th ..	1.8	—	33.6	2	35.1	2
June 18th-24th ..	36.3	4	21.6	2	39.6	2
June 25th-1st July ..	73.0	6	81.0	3	56.6	3
July 2nd-8th ..	65.9	3	173.3	6	52.3	3
July 9th-15th ..	27.4	3	128.2	4	64.0	3
July 16th-22nd ..	42.4	3	28.4	3	59.4	4
July 23rd-29th ..	28.2	2	26.9	2	59.7	2
July 30th-5th Aug. ..	72.9	3	28.4	2	45.2	3
Aug. 6th-12th ..	29.0	5	30.5	1	34.0	2
TOTAL ..	381.2	30	551.9	25	458.0	26
3. Nursery.						
Aug. 13th-19th ..	25.9	3	3.1	1	17.5	2
Aug. 20th-26th ..	86.8	5	62.6	5	52.1	1
Aug. 27th-2nd Sept. ..	11.2	1	9.1	3	43.7	3
Sept. 3rd-9th ..	36.5	2	—	—	28.2	3
Sept. 10th-16th ..	61.4	3	81.2	2	49.0	2
Sept. 17th-23rd ..	34.0	1	—	—	34.0	2
Sept. 24th-30th ..	9.6	3	64.7	2	38.4	2
Oct. 1st-7th ..	—	—	8.9	1	41.7	3
Oct. 8th-14th ..	10.9	1	338.8	5	46.5	3
Oct. 15th-21st ..	0.8	—	71.2	7	58.9	2
TOTAL ..	277.1	19	646.6	26	409.4	22
4. Transplanting.						
Oct. 22nd 11th Nov.	30.0	3	110.0	7	110.9	7
5. Growth.						
Nov. 12th-14th Jan. ..	—	—	95.9	5	3.8	—
6. Harvesting & Curing.						
Jan. 15th-1st April ..	—	—	87.7	2	23.7	3
TOTAL ..	716.1	55	1,596.3	72	1,131.9	69

* Average of 10 years.

Normally the flue-cured tobacco fields remain fallow during the rainy season and hence preparatory tillage operations could be given at any suitable time right from commencement of rainy season to late October, when plantings usually start. The rainfall and its distribution presented above, show that the 1957-58 was in general a dry season, characterised by a very dry nursery period when most of the preparatory tillage is done. However, 1958-59 was a very wet season with not only very excessive rainfall in pre-nursery and nursery periods but also during growth and harvesting periods. The abnormal rains received during the harvesting-curing period adversely affected the quality of leaf in 1958-59.

RESULTS AND DISCUSSION

The yield data per plot in respect of green leaf, cured leaf, bright leaf and Total Bright Leaf Equivalent (T.B.L.E.) were recorded during both the years of the experiment. The effect of various tillage treatments on the above characters are summarised in Table III.

The results show that the performance of the treatments varied with the season. While in the dry season of 1957-58, five tillage operations in various combinations proved to be as good as the farmers' practice (8 tillage operations), during the wet season of 1958-59, some of the combinations of 5 tillage operations proved to be significantly better than the farmers' practice. Treatments D, E and I, i.e., 5 harrowings only, 1 ploughing with country plough plus 4 harrowings and 1 ploughing with mould board plough plus 4 harrowings respectively, were significantly superior to control in green leaf yields. In cured leaf yields also, these treatments were better than control, though only treatment I (1 ploughing with mould board plough plus 4 harrowings) was significantly superior. The bright leaf and

Total Bright Leaf Equivalent yields were also higher in treatments E and I.

The poor yield of the control treatment and also of the treatments involving higher number of ploughings as compared to treatments D, E and I, i.e. only harrowings or one ploughing with four harrowings, in wet season of 1958-59 tend to suggest that too frequent cultivations with plough, not only did not give additional benefits, but on the contrary, depressed the yield. This may be due to the harmful effect produced on the soil structure by frequent ploughings. The soil being heavy in nature, frequent ploughings as preparatory tillage cannot always be given at the right stage in the rainy weather, without adversely affecting the soil structure. Consequently, it might have affected proper drainage and aeration of the soil and root growth of the plant, which in turn depressed the yield. Since harrowings stir only the top soil, they might not have produced such ill effects on the soil structure. During 1957-58, frequent higher ploughings may not have produced such harmful effect as the season was dry. Considering the performance of the various treatments over two seasons, treatment E tended to yield consistently higher than the control treatment. The data further indicate that reduction in the preparatory tillage operations from 8 (Farmers' practice) to 5 as tried in this experiment has in no way depressed the yield or quality.

As the tobacco soils in the tract are clayey in nature, rainfall during pre-planting period would normally limit the frequency and nature of preparatory tillage. It, therefore, seems desirable to give one ploughing either with a mould board plough or a country plough at the commencement of the monsoon, to open the compact soil for proper aeration and absorption of rain water. During the pre-planting period, there may not be further scope for ploughing operation, as it needs a

TABLE III. Effect of various tillage treatments on the yield and quality of flue-cured tobacco.

Treatments	Ploughing with		Yield in kilograms per acre									
			Green leaf		Cured leaf		Bright leaf		Total Bright leaf Equivalent			
	Iron mould board plough	Country plough	Harrowings	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
A	0	3	2	3,063	2,682	2,872.5	498	364	431.0	265	105	185.0
B	1	2	2	3,079	2,895	2,987.0	475	407	441.0	250	99	174.5
C	2	1	2	3,179	2,487	2,833.0	496	346	421.0	254	107	180.5
D	0	0	5	3,294	3,163	3,228.5	482	415	448.5	199	96	147.5
E	0	1	4	3,415	3,242	3,328.5	524	415	469.5	229	110	169.5
F	1	1	3	3,150	2,872	3,011.0	479	373	426.0	236	99	167.5
G	2	0	3	3,072	2,793	2,932.5	507	394	450.5	290	107	198.5
H	0	2	3	3,279	2,767	3,023.0	486	389	437.5	251	105	178.0
I	1	0	4	3,065	3,167	3,116.0	490	454	472.0	270	128	199.0
J	0	6	2	3,092	2,364	2,728.0	495	325	410.0	272	104	188.0
(Control) Mean				3,169	2,843	3,006.0	493	388	440.5	252	106	179.0
C.D. at 5%				N.S.	633		N.S.	117		N.S.	N.S.	N.S.

fairly dry soil. Weeds will, however, be a problem if no cultivation is given during this period. For this purpose, one or two harrowings during the break may be given reserving one or more harrowings for the final field preparation at planting.

Further work on shallow cultivation by harrowings alone and in combination with wooden ploughings on a site deep ploughed in summer is now in progress.

The soil moisture status at varying depths (0-6", 6-12", 12-18", 18-24") under different tillage treatments of the experiment was studied in both the years of the experiment. This did not show any variation among the treatments. Thus, even frequent tillage treatments which tended to adversely affect the yield of tobacco did not affect the soil-water relationship.

SUMMARY

The results of experiment on preparatory tillage for flue-cured tobacco on heavy black soils of East Godavari district are reported. In one of the experiments, it was found that repeated ploughings (12) with mould board plough during the season adversely affected the yield and the quality of flue-cured tobacco leaf.

In another experiment, of the nine treatments involving 5 tillage operations in various combinations of ploughings and harrowings tried in comparison with the cultivators' practice (6 ploughings with country plough plus 2 harrowings), it was found that combination of one ploughing (either with mould board or country plough) plus four harrowings were sufficient as preparatory tillage. These treatments proved better or as good as the farmers' practice. The fields should be ploughed as soon as the first good showers are received. Two to three harrowings may be given during breaks in the monsoon, reserving one to two harrowings for final preparation of the fields just before planting.

ACKNOWLEDGEMENTS

The authors wish to express their thanks to Dr. N. R. Bhat, formerly Director, Tobacco Research, for his valuable suggestions at the commencement and during the period of the experiments. They are also thankful to Dr. G. S. Murty, Director, Tobacco Research for going through the manuscript and suggesting suitable modifications in the text. Participation of Shri T. Krishnamoorthi, Shri H. T. Khemchandani and Shri R. Anantaraman in these studies is gratefully acknowledged.

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FACTORS RELATING TO OFF-TYPE TOBACCO—A SURVEY

IVAN NEAS*

There has been, over the last few seasons, considerable concern in the tobacco industry about certain off-types of tobacco appearing on the auction floors.

Results of experiments so far indicate that some of this off-type tobacco may be aggravated by leaf chlorine in excess of the 0.2 to 0.5 per cent levels recorded during the five-year period 1952-57 in tobacco purchased by the principal buyers of Rhodesian tobacco.

Garner ⁽¹⁾ reported that excess chlorine produces a muddy, uneven colour in the cured leaf and the excess is believed to be responsible for the sort of leaf commonly known as "wet dog" and this leaf from the bottom of the plant continues to darken and develop an undesirable odour after redrying and ageing.

Moseley ⁽²⁾ also reported a muddy grey colour and distinctly sour odour in first reapings with a high chlorine content.

SIGNS OF HIGH CHLORINE

The off-types, which appear to be aggravated by high chlorine, are tobacco with a sour or linoleum smell; tobacco with a dull muddy orange colour, particularly in the early reapings; and tobacco with a whitish slaty appearance. These tobaccos are also inclined to over-condition very easily.

Samples of tobacco reported to have an off odour were selected on the auction floors from the 1956-57 and 1957-58 crops for evaluation. The average chlorine content of

these samples was 0.91 per cent and 0.71 per cent respectively. The chlorine content of purchases by the principal buyers from the 1956-57 crop was between 0.2 and 0.3 per cent.

TRIALS OVER FOUR SEASONS

Experiments conducted by the Board over the last four seasons show that the leaf chlorine increased with increased rates of fertilizer chlorine (Table 1), with considerable variation from season to season (Tables 1, 2 and 3).

TABLE 1. *Percentage Leaf Chlorine with Rates of Fertilizer Chlorine on sandy soil. Kutsaga, 1955-56; 1956-57.*

Fertilizer Chlorine lb /ac.	Per centl. Leaf Chlorine	
	1955-56	1956-57
0	.15	.05
10	.28	
20	.46	.07
30	.53	.06
40	.68	.08
60	.67	
80		.11
160		.16

The leaf chlorine was low during the 1956-57 season. November-December 1956 was characterized by almost continual rainfall, with much less sunshine when compared with the

* Director, Tobacco Research Board of Rhodesia and Nyasaland.

same months of 1955. This would suggest that some chlorine may be lost through leaching.

The chlorine content of the leaf tended to decline as planting advanced from early September toward the first rain (Table 2).

TABLE 2. *Percentage Leaf Chlorine on a composite of third, fourth and fifth reapings from dates of planting—supplementary irrigation experiment on sandy soil. Kutsaga, 1955-56.*

Planting Date	Treatments	Per cent, Chlorine in Leaf (1)
Sep. 9	2 weeks without water, then irrigated weekly.	0.82
Sep. 9	Irrigated fortnightly until rains.	0.73
Oct. 17	2 weeks without water, then irrigated weekly.	0.53
Oct. 17	Dry-planted.	0.44
Nov. 8	Rain-planted.	0.51

(1) 20 lb. Fertilizer Chlorine was supplied.

IN THE IRRIGATION WATER

The chlorine content was higher with more frequent watering. More recent evidence has shown that this same source of water contained 20 parts per million of chlorine in October. This water would supply approximately 5 lb. chlorine per acre for each inch of water applied.

It would appear, therefore, that under the conditions of these experiments more was being added than lost through more frequent watering.

A rate of chlorine experiment at Trelawney during the 1957-58 season on a sandy loam

soil with heavier subsoil gave leaf chlorine greatly in excess of that previously observed, particularly in the bottom part of the plant. Even with no chlorine added in the fertilizer, the leaf in the first reaping contained approximately 1.0 per cent and with 20 lb. per acre fertilizer chlorine, approximately 4.0 per cent chlorine (Figure 1).

The leaf in equilibrium with the atmosphere at 60 per cent relative humidity in this and other experiments has shown an increase in moisture with increase in leaf chlorine. Much of this tobacco was, during grading, inclined to be over-conditioned.

THE PATTERN IS REPEATED

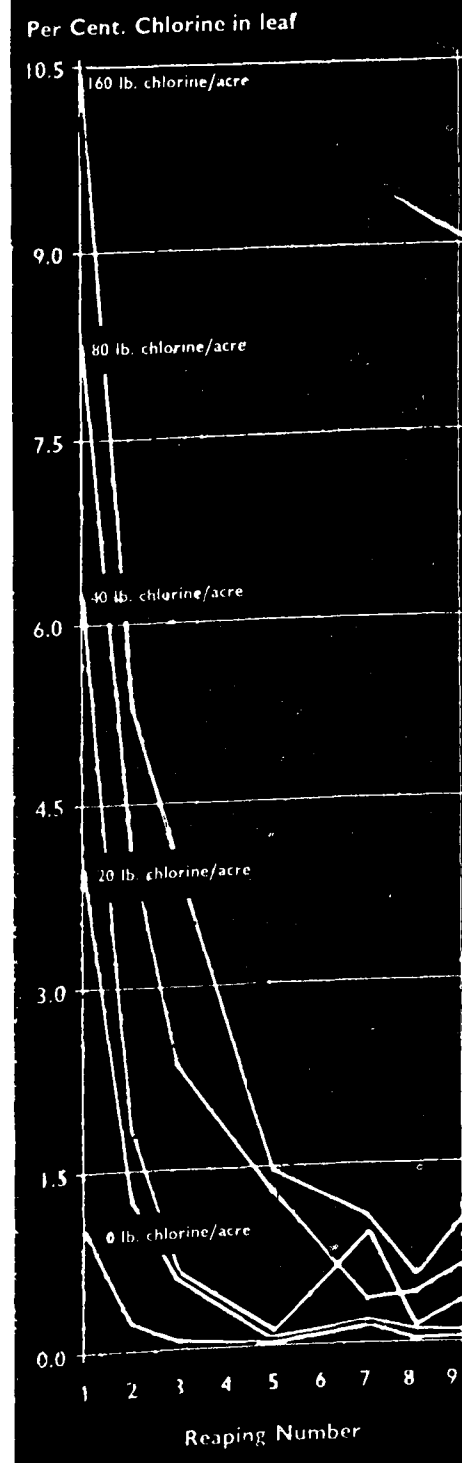
Though the work on the 1958-59 experiments is not complete some preliminary data on the early reapings from seven experiments at various locations in the country and on the Board's stations follow the pattern previously observed.

The chlorine content of the leaf increased with increased applications of fertilizer chlorine; decreased from bottom to top of the plant; and was higher on tobacco grown on sandy clay loam and vleis than on sands or loamy sands (Table 3). The percentage of chlorine was high on September-planted tobacco, and decreased with subsequent dates of planting.

The first reapings from the sandy clay loam and vleis had a sour odour and a dull muddy orange colour. Results from four experiments with rates of chlorine on sandy soil show an increase in yield and grade index where 20 lb. chlorine, the recommended rate for these soils, was used (Table 4). Data indicate that this 20 lb. chlorine per acre on sandy soils does not appear to aggravate these off-type tobaccos when the crop is not planted too early.

Results from fumigation experiments in 1953-54 and 1958-59 show that there is an

Figure 1. *Percentage of leaf chlorine with rates of fertilizer chlorine from a sandy loam soil with heavy subsoil. Trelawney, 1957-58.*



increase in the chlorine content of the leaf where dichloropropane-dichloropropane (DD), a chlorinated compound, is used as a fumigant.

TABLE 3. *Percentage Leaf Chlorine on a composite of fifth and sixth reapings from dates of planting—supplementary irrigation experiment on sandy soil. Kutsaga, 1956-57.*

Planting Date	Treatments	Per cent, Chlorine in Leaf (1)
Sep. 12	2 weeks without water, then irrigated weekly.	0.31
Sep. 12	Irrigated fortnightly until rains.	0.27
Oct. 1	2 weeks without water, then irrigated weekly.	0.24
Oct. 1	Irrigated fortnightly until rains.	0.25
Oct. 23	2 weeks without water, then irrigated weekly.	0.26
Oct. 23	Dry-planted (2 to 3 pints water).	0.29
Nov. 3	Rain-planted.	0.18

(1) 20 lb. Fertilizer Chlorine was supplied.

TABLE 4. *Percentage Leaf Chlorine, with Rates of Fertilizer Chlorine, from first reaping, in three experiments, 1958-59.*

Fertilizer Chlorine lb./acre	First reaping		
	Sandveld vleis	Loamy sand	Sandy clay loam
0	1.13	.07	1.03
20	1.46	.34	2.34
40	1.81	.50	3.91
80	2.15	.95	4.17



Signs of chlorine toxicity.

TABLE 5. Yield and Grade Index with Rates of Chlorine on sandy soil (four experiments, Kutsaga and Trelawney).

Fertilizer Chlorine lb./ac.	Yield	Grade Index
0	1188	41.8
20	1272	43.7
30	1215	43.7
40	1269	43.8

RECOMMENDATIONS

Where none of these off-type tobaccos have been produced, obviously there is no need to change the fertilizer mixture.

Reproduced from *Rhodesian Tobacco*, June 1959, with the kind permission of the Author and the Editor.

These tobaccos appear to occur more frequently where grown on vleis soils and soils with a high clay content or where a prolonged dry period follows transplanting, as in the case of September or early October tobacco.

If some off-type tobacco has been produced under some conditions such as very early planting or on certain soil types but not with normal planting or other soil types, consideration should be given to changing the time of planting or soil type rather than the fertilizer.

If, however, no other soil types are available then mixtures 2-18-15(A) or 4-18-15(B), with the potash derived from sulphate of potash, should be used.

Where these off-type tobaccos have been produced following DD fumigation, the all-sulphate of potash mixtures should be used.

Overseas data show, quite apart from the increased unbalance of nutrients, pronounced acidity may increase chlorine uptake. Therefore, where tobacco is grown on soils with a pH below 5.5, consideration should be given to liming. A liming programme should only be undertaken on the basis of a soil test recommendation.

REFERENCES

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SEMINARS

TESTING OF SOME COPPER FUNGICIDES AGAINST 'DAMPING OFF' FUNGUS (PYTHIUM APHANIDERMATUM)

The seminar group of the Central Tobacco Research Institute, Rajahmundry met on 29th January, 1960. Shri T. S. N. Reddy, Pathological Assistant presented in brief the tests conducted at the Institute with various copper fungicides and their efficacy in controlling the 'damping off' disease.

Introducing the subject, the speaker pointed out that 'damping off' disease is very serious especially in the nurseries raised on black cotton soils of Andhra Pradesh. The disease occurs in two stages viz. (1) Pre-emergence damping off and (2) Post-emergence damping off. The latter stage is of a longer duration and is more important. The studies were, therefore confined to the post-emergence damping off.

It was pointed out that Bordeaux mixture was a good fungicide, but its application was limited on account of the difficulties experienced in its preparation. The proprietary copper fungicides which are convenient to use were therefore

tested in field and laboratory conditions against 'damping off' disease. Under field conditions, the fungicides tested were (1) Coppesan, (2) Blitox, (3) Fytolan, (4) Wetcol, (5) Shell copper, (6) Micop, (7) Fungi copper, (8) Perenox, (9) Dithane Z-78, (10) Cheshunt compound and (11) Bordeaux mixture. One prophylactic spraying with the respective fungicides and then post sowing sprayings were given. Of the various fungicides tried under field conditions, Coppesan, Blitox, Fytolan, Perenox, Shell-copper, Micop, Fungi Copper and Bordeaux mixture controlled the disease equally well, while Wetcol, Dithane Z-78, and Cheshunt compound were not so effective.

Under laboratory conditions, it was found that Blitox at 8 parts per million, Micop and Coppesan at 16 p.p.m., Cupervit at 31 p.p.m., Fytolan, Perenox, Shell-Copper and Cupramar at 63 p.p.m., Fungi Copper and Sanxoz-Copper at 125 p.p.m., and Fungimar at 250 p.p.m. completely inhibited the growth of the fungus.

STUDIES ON VIABILITY OF FLUE-CURED TOBACCO SEED STORED AT ROOM TEMPERATURE FOR DIFFERENT PERIODS

At the monthly seminar meeting held on 26th February, 1960, Shri I. V. G. Krishnamurthy, Training & Demonstration Officer, gave a talk on the above subject.

Introducing the subject, the speaker pointed out that the studies on the viability of flue-cured tobacco seed stored at room temperature for different periods were undertaken mainly with a view to advising the tobacco growers as to how long they could safely use the seeds stored by

them for nursery sowings.

Experiments conducted have shown that flue-cured tobacco seeds when packed in butter paper bags and stored at room temperature keep satisfactory viability only during the season of their collection. There is a considerable deterioration in their viability after one year. However, if the seed is treated with silver nitrate solution, the seed retained their viability for one year beyond the year of their collection.

LABORATORY STUDIES ON INSECTICIDES AND THEIR RESIDUAL EFFECT AGAINST TOBACCO CATERPILLARS (PRODENIA LITURA F.)

At the monthly seminar meeting held on 23rd March, 1960, Shri B. G. Joshi, Entomological Assistant, gave a talk on the above subject.

Shri Joshi in his introductory remarks pointed out that *Prodenia litura* F. commonly known

as the Tobacco caterpillar is a major pest in tobacco nurseries and on the young crop of tobacco in the fields. The damage is caused by their feeding on tobacco leaves. The caterpillars are voracious feeders and are capable of defoliat-

ing the whole nursery within a week if suitable control measures are not taken in time. Generally, the 3rd and 4th instars, medium sized ones, cause more damage as they are voracious eaters.

Presenting the experimental details he said that D.D.T. 50% W.P. (Guessorol 550), Rhothane 50% W.P. and Endrex 20% E.C. were tested in pots in laboratory for 2 years. Endrex was included as it is more commonly used by farmers in this area. The caterpillars were introduced before and after spraying to find out the contact and stomach action of these insecticides. Observations were taken about the number of seedlings damaged by these caterpillars per pot.

It was observed that all the three insecticides used in the tests were more or less equally effective in preventing the damage of the seedlings

by these caterpillars. No significant differences were found in number of sprayings. Sprayings before or after the introduction of caterpillars had more or less the same effect.

In the residual effect studies, it was found that the residual effect of D.D.T., Rhothane and Endrex lasted for 15, 12 and 9 days respectively.

From the tests conducted, it can be said that it is advantageous to use D.D.T. against caterpillars than Endrex as the former is not only as good as the latter in its effect in the beginning, but in addition keeps its residual effect for more number of days. Further D.D.T. is cheaper and more safe to handle than Endrex. To spray one acre of nursery at the rate of 7 gallons per 100 sq. yards D.D.T. costs Rs. 20/- while Endrex will cost Rs. 38.00.

SEMINAR ON INDIAN TOBACCO

The Indian tobacco trade and industry will be holding a Seminar on Indian tobacco at Guntur for 3 days from 10th July 1960. This is being held with a view to having co-ordinated discussions on all the problems relating to tobacco in general and of cigarette tobacco, in particular. Growers, traders, manufacturers, officials of the State and Central Government and technical experts are expected to participate. The Union Minister for Agriculture, Dr. P. S. Deshmukh is expected to inaugurate it and Shri N. Ramachandra Reddy, Minister for Agriculture, Andhra Pradesh to preside over the function.

DRAFT INDIAN STANDARDS FOR CIGARS AND CHERROOTS

The Indian Standards Institution has recently prepared the following two draft specifications prescribing requirements for cigars, cheroots and chuttas (country cheroots) :—

1. Cigars and Cheroots [Doc : AFDC 13(91)], and
2. Chuttas (Country Cheroot) [Doc : AFDC 13(92)].

Different brands of cigars, high class cheroots and chuttas are manufactured in this country varying in cost depending upon the leaf tobacco used, the processing employed and their finish. The range of different types of cigars, cheroots and chuttas produced in the country is very wide and it has become necessary to lay down certain minimum specifications for them. The broad objective of these standards will be not only to enable the Indian consumer to get the standard products, but will also be to help in promoting the export of these products.

The draft standards are being circulated for eliciting technical comments, to producers, consumers, technologists and other interests concerned. The last date for the receipt of these comments is 16th August 1960.

Copies of the draft standards are available, free on request, from the office of the Indian Standards Institution, 'Manak Bhavan', 9, Mathura Road, New Delhi-1 and from its Branch Offices located at Bombay, Calcutta and Madras.

INDIAN STANDARD SPECIFICATION FOR SNUFF TOBACCO

The first meeting of the Hookah, Chewing and Snuff Tobacco Sub-Committee (AFDC, 13:4) was held on 26th May 1960 at Ahmedabad with Dr. G. J. Patel as the convener. Dr. M. S. Patel, Secretary, Indian Central Tobacco Committee and Chairman of the Tobacco Products Sectional Committee was also present to guide the work on drafting Indian Standard Specification for Snuff tobacco.



Left to Right : Shri A. F. Patel, Editor, TAMAKU, Shri Purushothamdas Chhikniwala, leading snuff manufacturer, Dr. M. S. Patel, Secretary, Indian Central Tobacco Committee, and Chairman, Tobacco Products Sectional Committee (AFDC, 13), Dr. G. J. Patel, Convener, AFDC 13:4, and Shri O. P. Dhamija, Extra Assist. Director, Indian Standards Institution.

The Sub-Committee discussed at length the preliminary draft Indian Standard Specification for Snuff tobacco. Dr. M. S. Patel was of the opinion that there was need to collect information regarding the various adulterants which are generally mixed in tobacco snuff and if possible to ascertain and eliminate the harmful organic adulterants. It also required to be ascertained whether snuff powder could be standardised dimensionally or otherwise. The convener agreed to look into this matter from the view points expressed by Dr. M. S. Patel and the members present representing the industry etc., expressed their willingness to supply free of charge the samples of different varieties of snuff for such a study. Draft Indian Standard Specification for snuff tobacco will be drawn for consideration by the Tobacco Sectional Committee AFDC 13 at its next meeting, after the required information has been collected and examined.

FARMERS' WEEK CELEBRATIONS

(i) AT THE CENTRAL TOBACCO RESEARCH INSTITUTE, RAJAHMUNDRY:

Farmers' Week was celebrated from 16th to 20th February, 1960 to explain to the tobacco cultivators the progress of the work and the results achieved by the Institute and also to discuss their problems with a view to taking suitable steps for their solution. The function was inaugurated on 16th February, 1960 by Shri T. Venkatappaiah, Vice-President-elect of the Indian Central Tobacco Committee, and presided over by Shri Ch. Durga Prasad, President, Seetha-

nagaram Block. A large gathering of cultivators and officials were present on the occasion.

Besides the Vice-President-elect, Shri Prasad, the Director, Tobacco Research and the Deputy Director of Agriculture, Eluru and two tobacco cultivators also addressed the gathering explaining the difficulties facing tobacco producers, particularly the unremunerative prices they were getting for their produce.

The cultivators and the officials were shown round the field experiments and barns. Some cultivators visited the farm in subsequent days also.



Shri Venkatappaiah addressing the gathering.

(ii) AT THE HOOKAH AND CHEWING TOBACCO RESEARCH STATION, PUSA:

The Farmers' Week was celebrated from 8th to 14th February, 1960, to acquaint the tobacco growers with the nature and progress of research work being carried out at the Research Station. A public meeting was held on the 14th February, 1960 under the presidency of Dr. A. S. Chakravarty, In-charge, Sugarcane Research Institute, Pusa. The meeting was largely attended by tobacco growers and officials.

An exhibition showing the results achieved was organised for the occasion. A competition of the tobacco produced by the cultivators, was also held and the producers of the best three samples were awarded prizes.

(iii) AT THE WRAPPER AND HOOKAH TOBACCO RESEARCH STATION, DINHATA:

The annual Farmers' Week was celebrated from February 3rd to 10th 1960. Shri J. K. Lahiri, I.A.S., Deputy Commissioner, Cooch Behar, inaugurated and presided over the function. A large number of tobacco growers and local officials of the various Government departments were present.

An exhibition depicting the various research activities undertaken at the Station was also arranged. Interested tobacco farmers and a large number of students from the Agricultural School, Cooch Behar, visited the Station during the week.

INDIAN TOBACCO

Gleanings From WORLD LITERATURE on TOBACCO

By-Products:

HOPMANN, E. and HOFFMANN, G., 1958: Detection of phenols on paper Chromatograms, *Naturwissenschaften* 45 (14): 337-38 (German).

Dried chromatograms are sprayed with a freshly prepared 0.3% methanolic solution of 2, 6-dibromo-p-benzoquinone-chlorimine. Drying in hot air causes some phenols to appear immediately; others do not appear until the paper receives a second spraying with 0.1% aqueous NaHCO_3 solution. As little as 1 μg of most phenols can be detected. Color reactions for several phenols are given. (From abstract).

Analyt. Abs. 6(6): no. 2227, June 1959.

SAWICKI, E., *et al.* 1959: Isatin tests for aromatic hydro-carbons and phenols, *Analy. Chem.* 31(10): 1664-7, Oct. graphs, tables.

Joint authors: Stanley, T.W.; Hauser, T. R. Barry, B.

The reaction of certain isatin derivatives with phosphorous pentachloride apparently yields isatin chlorides which readily give cationic resonance dyes with phenols and polynuclear aromatic hydrocarbons. The reaction of ten isatin derivatives with polynuclear aromatic hydrocarbons to give a hitherto unknown class of indigoid dyes absorbing at very long wave lengths has been developed into a new method for the spectral detection of the more basic aromatic hydrocarbons. As phenols and volatile hydrocarbons are not present in the neutral

aromatic fraction of air particulates collected with a high volume air sampler, the isatin test procedure applied to these fractions is probably specific for the pericondensed aromatic hydrocarbons. (From abstract).

SCHRAMM, R. W. and ORGANISLAK-MATUSZAK, 1958: Zastosowanie chromatografii bibuowej do analizy barwników chloroplastów. (Use of paper chromatography in the analysis of chloroplast pigments) (*Soc. Pot. Polon. Acta* 27-299-311, illus. tables (Polish)).

Chloroplast pigments of 21 plant species were quantitatively and semiquantitatively analysed with the following mixtures, acetone-ethanol (2:1) for extraction; chlorobenzol for preservation; benzol:petroleum ether:acetone (10:2, 5:1.5) for separation. The chromatograms of fresh leaf extracts were fairly distinct from those preserved extracts. No effect of light and oxygen in air on the chromatograms was noted. The R_f values of the different pigments were in part dependent on their own concentration (Pheophytin and xanthophylls) and on the concentration of the other components (chlorophylls).

LZB. II. 4(8): 1593, Aug. 1959.

BOWERY, T. G., *et al.* 1959: Insecticide residues on tobacco, *J. Agri. Food. Chem.* 7(10): 693-702, Oct. graph, tables.

Joint authors: Evans, W. R.; Guthrie, F. E., Rabb, R. L.

APRIL-JUNE 1960

TDE and endrin residues on green tobacco during priming time are above 50 and 10 ppm, respectively. These residues are dissipated about 45% during processing. Auction market tobacco contains approximately 37 ppm of TDE and 1.8 ppm of endrin. An average of 13 μg of TDE and 0.2 μg of endrin are found per commercial cigarettes. TDE and dehydrochlorinated TDE have been measured in the mainstream smoke of commercial cigarettes at 1.6 and 1.4 μg per "smoked cigarette". Further education is needed on the application of these insecticides to minimise the residues. (From abstract).

CONNORS, W. M. and HESS, E. H., 1959: Determination of calcium in tobacco. Tob. Chem. Res. Cont. 13th Lexington, Ky. Oct. 1959, Papers No. 13. (Abs.).

The amounts and patterns of distribution of calcium in tobacco are assumed to remain constant during its curing and fermentation. Accurate calcium analyses of tobacco at various stages of processing permit the calculation of weight loss factors associated with the curing and fermentation processes. The sources of error in the standard AOAC method of calcium determination were determined and an alternate more precise method developed based on the Willard and Furnan technique. The calcium values thus obtained when used in weight loss calculations have been useful in the interpretation of analytical data concerning the soluble nitrogenous compounds of Connecticut Shade tobacco.

CUNDIFF, R. H. and MARKUNAS, P. C., 1959: Modification of the extraction procedure for determination of alkaloids in tobacco. Tob. Chem. Res. Cont. 13th Lexington, Ky. Oct. 1959, Papers No. 1 (Abs.).

The Cundiff-Markunas alkaloid procedure gave low results for total and secondary amine alkaloids on tobaccos proportionately high in secondary amine alkaloids. The reasons for these low results were investigated by analysing nicotine and nornicotine picrate mixtures and high secondary amine alkaloid tobaccos. The procedure was modified by changing the method of making the tobacco alkaline and by increasing the proportion of chloroform in the extracting solution. With these modifications, quantitative recovery and resolution of nicotine and nornicotine from their picrate mixtures was affected.

The procedure was further improved by devising means whereby all tobacco extracts may be titrated visually. Heretofore, acetylated extracts proportionately high in secondary amine alkaloids had to be titrated potentiometrically. Comparable results were obtained by both the original and modified procedures on analysis of commercial cigarette and smoking tobaccos which contain small amounts of secondary amine alkaloids. Appreciably higher results for total and secondary amine alkaloids were realized with the modified procedure on analysis of high secondary amine alkaloid-type tobaccos. Results on a number of samples were also compared with those obtained by the Griffith procedures.

FITZGERALD, J. S., 1959: Gas chromatography applied to the analysis of phenols. Austral. J. Appl. Sci. 10(2): 169-89., June, graphs, tables.

Phenolic mixtures may be partially separated by gas chromatography either on polar or non-polar stationary phases, different groupings of the phenols being obtained on the two types. For more complete resolution of mixtures both types of phase should be used. "Apiezon-L" grease and sodium dodecylbenzene sulfonate were among the most useful materials examined, the second being used in the form of a spray-dried mixture with sodium sulfate, which was available as an industrial detergent. Methylation of alkyl substituted phenols prior to chromatography is disadvantageous, although like treatment of chlorinated or dihydric phenols may be helpful. Both these latter groups can be partially separated by gas chromatography on a limited number of liquid phases. (Summary).

HELLIER, D. N. and REID, W. W., 1959: Lipids of tobacco and tobacco smoke. Tob. Chem. Res. Cont. 13th Lexington Ky., Oct. 1959, Papers No. 20. (Abs.).

After preliminary separation into soft and hard resins and hydrolysis, sub-fractionation was carried out on alumina and silica gel, of neutral and acidic fractions. The fractions were examined by reversed phase chromatography. Preliminary studies have been carried out in the same manner from fresh *Nicotiana* leaf fed $^{14}\text{CO}_2$ or 2- ^{14}C acetate or (±)-2- ^{14}C mevalonic acid lactone. The lipid fraction, from cigarette smoke has been examined in a similar manner to determine the lipid constituents distilled during the course of smoking. Great difficulty was experi-

enced in isolating homogenous components from the hard resin fractions of tobacco. Molecular weight determination indicated molecular weights in the range 600-1000. Results on the polymerization of the lipid fraction were presented.

STEDMAN, R. L. and RUSANIWSKYJ, W., 1959: Burley tobacco: Quality vs. chemical composition. Tob. Chem. Res. Cont. 13th Lexington, Ky., Oct. Papers No. 14. (Abs.).

A specific method for the determination of paraffinic hydrocarbons includes the following steps: extraction of tobacco with Skellysolve B, treatment of the extract with concentrated sulphuric acid; column chromatography of substances resulting from the acid treatment and crystallisation from ethanol of the material eluted by petroleum ether. The product obtained with this procedure shows no traces of unsaturation or oxygen containing components and has a melting point, infrared spectrum and X-ray diffraction pattern typical of paraffinic hydrocarbons. Using this procedure, representative commercial samples of aged or fermented tobaccos were analysed. Levels of paraffin from 0.24-0.43% were obtained from flue-cured, burley, Maryland, Turkish, fire-cured and cigar tobaccos.

Paraffins and total 3-beta-sterol levels were then determined in a series of U.S. grades of burley tobacco. No relationship between leaf quality and concentration of paraffins or sterols was noted.

WRIGHT, H. E. Jr., et al. 1959: Identification of nondialyzable brown pigment from aged burley tobacco. Tob. Chem. Res. Cont. 13th Lexington, Ky., Oct. 1959, Papers No. 12. (Abs.).

Joint Authors: Burton, W. W., Berry, R. C. Jr.

A dark brown pigment was isolated from the nondialyzable fraction of an aqueous extract of aged burley tobacco pre-extracted with a series of organic solvents. The pigment, identified as an iron-protein-chlorogenic acid-rutin complex, highly polymerized, was isolated in an amount corresponding to 0.32% of dry leaf weight. Identification was made by paper chromatography of the hydrolytic and potassium hydroxide fusion products. Eighteen amino acids were identified in hydrolysates of the protein moiety. The product possesses powerful chromogenic properties and is one of the pigments which, collectively, are primarily responsible for

the colour of cured burley tobacco. Identification of the natural pigment confirms the participation of both chlorogenic acid and rutin in the browning of air-cured tobacco.

Cultural Practices, Field:

ANANTH, K. C., 1959: Growth and yield studies on nitrogen fertilization of Cherooot, Hookah and Chewing types of tobacco (*Nicotiana tabacum* L.) Allahabad Farmer 33(3): 165-81, May, tables.

Variety Vellaivazhai showed best response to nitrogen fertilization. Variety I.P. 70 responded poorly. The highest concentration (120 lbs. N/acre) affected growth noticeably. Poorest response was in the control plot. I.P. 70 yielded the highest amount of cured leaf per acre. Vellaivazhai the poorest. A level of 80 lbs. of N/acre for the variety Vellaivazhai and 120 lbs. N/acre for I.P. 58 and I.P. 70 is recommended for Banaras (India) conditions. (From summary).

McEVoy, E. T. and HOFFMAN, I., 1959: Use of chemicals to suppress sucker growth on cigar tobacco. Canad. J. Plant Sci. 39(3): 359-4, July, tables.

A mineral oil-water emulsion applied to the stub of the broken stem after the plant was decapitated and diethanolamine salt of maleic hydrazide sprayed on the leaves suppressed sucker growth significantly and increased the yield of the cured crop. Each chemical treatment resulted in a decrease in the percentage content of total alkaloids, nicotine, calcium and total ash in the cured leaf but had no apparent influence, on the content of total nitrogen, nornicotine, potassium, phosphorus, magnesium and chlorine. (From abstract).

TOTSUKA, T. and MONSI, M., 1959: Effect of water economy on plant growth. I Influence of water level lowering on the growth of water-cultured tobacco plants. Bot. Mag. (Tokyo) 72(855): 367-74 graphs, tables.

2, 4, 6 and 8 cm. sets were prepared. Plant growth in dry weight was decreased in proportion to the water level lowering, i.e. the relative values of 100:87.5:78.9:68.6 were observed at the 2, 4, 6 and 8 cm set., respectively. The lowest net assimilation rate (NAR) was obtained at the 8 cm set. The ratio of the dry weight of nonphotosynthetic organs to the leaf area indicated no difference among the sets. With lowering the water level, heavy water deficit was

induced in leaves, but no deficit was observed in stems and roots. A clear relationship was discovered between the leaf water deficit and the ratio of submerged roots to leaf area (active root/leaf area ratio), which was used here as an indicator of the grade of water level lowering. The net assimilation decreased almost linearly with progress of the leaf water deficit, while no change was observed in respiratory activity of leaves as to water deficit and no special depression of nitrogen content in leaves was detected during the experimental period. The growth in dry weight at the 2 cm-and-8-cm-sets was calculated theoretically with the net assimilation, which was affected by the leaf water deficit caused by water level lowering. The agreement between the calculated and the observed proves that the primary cause of the growth depression with water level lowering is the suppressed photosynthesis of leaves. (Summary).

Diseases :

(i) FUNGUS

ROSSOUW, D. J., 1959: Invloed van temperatuur en humiditeit op die poeieragtige meeldouswam van tabak. (Effect of temperature and humidity on the tobacco powdery mildew fungus). So. African J. Agri. Sci. 2(1) : 19-31 March. Graphs table. (Afrikans).

The influence of temperature on the germination of conidia and on the infection of tobacco by powdery mildew was determined. For the former the minimum optimum and maximum temperatures were found to be lower than 5°C, between 24-25°C and between 30-35°C and for the latter 5°, 23.5° and 25°C respectively. A very close correlation between the occurrence of powdery mildew in certain tobacco areas and the average daily maximum-minimum temperatures prevailing in those areas was shown. Powdery mildew did not occur in areas in which the prevailing maximum-minimum temperatures were 25°C or higher. Relative humidity has much less influence than temperature on either the germination of the conidia or the occurrence of powdery mildew in different tobacco areas. The conidia could germinate under conditions in which the relative humidity varied from 0-100% between temperatures of 15° to 30°C. Furthermore, no correlation between relative humidity and the occurrence of powdery mildew could be found. (From English summary).

(ii) NEMATODES

NUSBAUM, C. J., 1959: Effects of cultural practices following tobacco harvest upon root-knot nematode populations. Phytopathology 49(9) : 547-8 Sept. (Abs.).

The effects of certain post-harvest cultural practices upon root-knot nematode (*Meloidogyne incognita* and *M. incognita acrita*) populations have been studied. Tobacco roots left undisturbed in the soil after harvest favoured the build-up of nematode populations during the fall and overwintering or inoculum; plowing-cut or disking roots immediately after harvest, or sowing small grain covercrops following plowing or disking prevented further nematode reproduction and reduced winter survival to less than 10%. Such reductions in nematode populations resulted in a lower incidence of root-knot in the succeeding tobacco crop and improved crop performance. These fall cultural treatments play an important role in the nematode control program.

NUSBAUM, C. J., 1959: Role of land management practices in controlling nematode diseases of tobacco. Chilean Nitrate. Farm Forum 64 : 21-2 July.

BAG. 23(9) No. 71282, Sept. 1959.

Genetics :

CHAPLIN, J. F.: Interspecific hybridization, gene transfer, and chromosomal substitution in *Nicotiana*. Thesis Ann. Arbor. Mich. Univ. Microfilms L., C. Card No. Mic. 59-2511.

Attempts were made to cross twenty-four *Nicotiana* species with autotetraploid *N. tabacum*. Estimates for cross-compatibility between autotetraploid *N. tabacum* and these *Nicotiana* species, the viability, and fertility of the hybrids were obtained. In most cases, the cross-compatibility between autotetraploid *N. tabacum* and the species was the same as that reported when diploid *N. tabacum* was used, except for the *N. Rustica* population. To study chromosomal substitution and interspecific gene transfer, two market stocks of *N. tabacum* were used. One was the (yg) factor from Consolation and the other was (yb) factor from Burley. There was little difficulty involved in transferring the (yg) factor from *N. sylvestris*, *N. otophora*, and *N. tomentosiformis* into *N. tabacum*. The data presented indicated that a substitution of a chromosome carrying the (yg) factor from the following

species into *N. tabacum* occurred: *N. paniculata*, *N. Plumbaginifolia*, and *N. rustica*. The segregation ratios obtained, when the substitution heterozygotes were self-pollinated, indicated little or no pairing between the alien chromosome and its *N. tabacum* counterpart.

(DA 20(2) : 461, Aug. 1959.

IAKOVUK, A. S., 1959: Voprosy teorii i praktiki polucheniia gibridnykh semian tabaka. (Problems of obtaining hybrid tobacco seeds) Vest. sel'skokhoz. Nauk. 8 : 27-33, Aug. tables. (Russian).

The number of hybrid plants in the progeny of non-castrated plants exceeded 80% in the majority of crossings. A higher percentage of hybrids in the progeny of non-castrated flowers was observed in those cases when the paternal variety possessed higher biological activity (energy of growth) than the other component. Pollination with a mixture of pollen taken from the component varieties changes the type of heredity, apparently indicating the maternal role of maternal pollen contained in the mixture. The best results were obtained when the pollination of non-castrated flowers was done on the day before the opening of the corolla. (English abstract).

STOKES, G. W., 1959: Interspecific transfer of wildfire resistance and varietal reaction. Phytopathology 49(9) : 551, Sept. (Abs.).

Resistance to the wildfire bacterium, *Pseudomonas tabaci*, has been transferred from *Nicotiana longiflora* to *N. tabacum* and is present in the varieties Burley 21 and Ky 61, respectively, released from the U.S.D.A. and the Kentucky Agricultural Experiment Station. The interspecific hybrid *N. tabacum* (n=24) × *N. longiflora* (n=10) is reported (Goodspeed) to have a pairing range of 5-9 II at meiosis.

Crossing over between homologous regions of the paired chromosomes is possible and probable with homology at this level. If the crossover included the wildfire segment, the exchange would yield a *N. tabacum* chromosome carrying the gene for wildfire resistance. Similar wildfire reactions in the above varieties would be expected if this were the case. F₁ progenies from crosses between Burley 21 and Ky 61 on susceptible plants were different in their reactions to *P. tabaci*. Progenies of Burley 21 were more uniformly resistant than progenies of Ky 61, indicating that the gene for wildfire resistance is more

efficient in Burley 21. This could be due to a position difference in the *N. tabacum* genome.

WITTMER, G., 1959: Correlazioni fra caratteri quantitativi in *Nicotiana*. I. Studio dell'variabilità di alcuni caratteri fiorali. (Correlations between quantitative characters in *Nicotiana*, I. Study on variability of dimensions of flower parts). Tabacco 63 (691) : 161-88, illus., tables. (Italian).

Floral characters measured were throat width, corolla edge width, lobe base, lobe median, ratio between the latter dimensions, corolla length, distance between corolla base and point where the corolla tube becomes ventricose. The varieties included Erbasanta (*N. rustica*) Virginia Bright, Maryland, Burley (*N. tabacum*). Frequency distribution for the studied traits are given. Analysis of variance, correlations between traits and estimates of h² (heritability) for the different traits were obtained. The differences, for the considered traits, between varieties (and species) are always highly significant. In the same variety the differences between two environments are always significant and in the same environment the differences between plants are also significant for almost all traits. In changing environment, six of the considered traits in one variety and four in another changed always in the same direction. Two pairs of traits (1) Ac (corolla length) and Db (distance between corolla base and point where corolline tube becomes ventricose) and (2) R1 (width of edge of corolla) and B (width of corolla base), exhibited the same association in all the varieties and in all the environments. The studied flower part dimensions show a high value of heritability. (From English summary).

Harvesting and Curing :

SCOTT, W. A., 1959: Investigations on curing burley tobacco with artificial aids. Canad. J. Plant Sci. 39(3) : 284-92, July. graphs, illus.

In one method temperature and humidity controlled heaters were used, and in the other a specially constructed calcium chloride dehydrator. Both methods were compared concurrently with natural air curing in respective pilot barns of three-quarter acre capacity. A similar comparison of curing was made in heated and unheated three-acre capacity barns through two curing seasons. Supplementary heating produced

the best results (improved quality, increased yields) but was ineffective during exceptionally cool weather. (Abstract).

AMARELL, H., 1959: Über die Trocknung des Tabacks. (Curing of tobacco). Deut. Agrtech. 9(5): 221. Illus. (German).

Although the greater part of the tobacco crop in the German Democratic Republic is cured by traditional hanging method (4-6 weeks), a number of brickbuilt coalburning hot-air fan-drying barns have been installed. These effect curing in 20 hours at a temperature of 34-35°C with 80% r.h., followed by drying of the leaves in a temperature slowly raised from 35 to 55-60°C and drying of the ribs quickly at 75°C. The process is completed by cooling for 3 hr and moistening again for 4 hr to reach 18% m.c. AHEA 10(3): no. 1055, 1959.

CLARK, C. M., 1959: Development of light standards for grading tobacco. Tob. Chem. Res. Conf. 13th, Lexington, Ky., Oct. 1959. Papers no. 4. (Abs.).

The research work of the Kentucky Agricultural Experiment Station on developing desirable light conditions for grade evaluation of tobacco is based largely on experiments with the cotton Examolite lamp used in the cotton trade. Three years of experimental testing may be summarized as follows: Quantity of light—100 ft. candles. Quality of light—ratio of two watts of incandescent light to one watt of blue-white examolite fluorescent. Background—light neutral gray color (Mumsell 6-9). A number of farm stripping sheds were equipped to meet the above conditions for electrical sources of light. The following advantages over that of daylight or other sources of electric light were noted: (1) Much less fatigue from long hours of work. (2) Greater ease in identifying the change or break in color shades of the leaf. (3) Faster stripping and more accurate classification of the leaf.

Insects:

BUNZLI, G. H. and BUTTIKER, W. W., 1959: Comparative study of the soil conditions favoured by certain Melolonthid and Tenebrionid pests of tobacco in Southern Rhodesia. B. Ent. Res. 50(2): 259-63, Aug. graph, tables.

Observations were made on mixed populations of the white grubs, larvae of *Anomala extitatus*

Per. and *Schizonychia profuga* Per. (Melolonthinae), and on those of the false wireworms, larvae of *Psemmodes similis* Per. and *P. scrobicollis* (Fhs.) (Tenebrionidae). The habitats favored by white grubs had a higher clay, silt and organic matter content than those favored by false wireworms. Heavy infestations of tobacco fields are associated with 60,000 white grubs or 1,500 false wireworms per acre. The life cycle of both insect larvae is described. The infestations by the two classes of insects do not overlap in space to any great extent but are governed by the nature of the soil, the white grubs favoring areas in which the soil has a higher nutrient value and the false wireworms areas where the soil is poorer. Reference is made to parasitisation of white-grub larvae in two areas, where the soil had an abnormally high nitrogen content, by a species of *Tiphia* in the one area and by entomogenous fungi in the other. False wireworms have not been found to be similarly attacked under field conditions. (From summary).

MURDOCK, D. I., 1958: Factors to consider in controlling insects in a feed warehouse. Florida State Hort. Soc. Proc. 71: 227-33.

Saw-toothed grain beetle, cigarette beetle, and several species of moths are the principal insects infesting stored citrus pulp. A successful insect control program is dependent upon a clean warehouse and feed mill. Recently, pyrethrum in the form of wettable powder has been successfully used in obtaining a higher degree of insect control. Tolerances for pyrethrum in dried citrus pulp must be established by the Food and Drug Administration before this treatment can be adopted commercially.

BA 34(1): no. 2808, Sept. 10, 1959.

Physiology and Biochemistry:

MACHLACHLAN, G. A. and PORTER, H. K., 1959: Replacement of oxidation by light as the energy source for glucose metabolism in tobacco leaf. Roy. Soc. London Proc. Ser. B. 150(941): 460-73, Sept. 1. graphs, illus., tables.

Tobacco-leaf disks synthesized starch and sucrose when infiltrated with 5% solutions of glucose-1-¹⁴C and kept in light under the anaerobic conditions produced by a reduced air pressure of 2 cm mercury (vacuum). In the dark, glucose was absorbed into the leaf cells but

there was no synthesis, CO₂ output was low and there was no evidence for fermentation of glucose. Respiration on transfer to air after 24 hours of vacuum treatment showed that in the light the respiratory mechanism had been maintained intact but in darkness it was irreversibly damaged. In the sucrose and starch synthesized, an average of 75% of the total ¹⁴C was in the position (1 or 6) originally labeled, 15% appeared in the other terminal carbon atom, and the remaining ¹⁴C was unevenly distributed between carbons 2 to 5. With this type of distribution, the products must be attributed predominantly to polymerization of hexose or triose. It is concluded that the phosphorylation of glucose, essential to such syntheses, was light, induced by reactions which proceeded anaerobically. In similar experiments in air, starch and sucrose again derived mainly from the glucose substrates. There was evidence both for some reassimilation of respired ¹⁴CO₂ and photophosphorylation of glucose. (Abstract).

POLIAKOV, I. M., et al., 1958: Application of radioactive isotopes in the study of plant fertilization. Internat. Conf. Sci. Res. (UNESCO) First. Proc. 4: 323-39.

Joint authors: Dmitrieva, A. N. Zdrilko, A. F.

A new method of investigating the processes of fertilization of higher plants (tobacco, maize, cotton, kenaf, peas and others) through the use of pollen labeled with the radioactive isotopes of S³⁵ or P³². Repeated pollination of the same flowers, first with ordinary pollen and then with pollen labeled with S³⁵ or P³², showed that the organic compounds of the pollen used for the later pollinations (that is of seeds that had already begun to develop), passed into the seeds. The variation in the quantity of these compounds in the seeds is usually regular, depending on the time of the subsequent pollination. It is possible experimentally to characterize the quantitative aspect of the processes under study. If we know such factors as: (a) the number of pulses produced by one gram of seeds, (b) the number of seeds per gram, it is possible to calculate approximately how many pollen tubes contributed labeled compounds to one seed or seed bud. The major part of P³² and S³⁵ enter the complex organic compounds of the pollen. These compounds pass into the ovary via the pollen tubes; here they undergo a series of transformations and largely become part of the organic com-

pounds of the seeds. Not more than 10-15% of the total quantity of this P³² or S³⁵ enters the ovary by other means (i.e. "diffusion" processes) than through the pollen tubes. An experimental verification is made of the role of the placenta as a "reservoir" in which compounds brought in by supplementary pollen tubes accumulate and also of the further redistribution of substances between the placenta and the developing seeds. New data obtained by this method show the inter actions of the pollen of different species, and in particular of mixtures of pollen used in distant hybridization.

BA 34(1): no. 2514, Sept. 10, 1959.

SEO, Y., 1957: Effect of magnesium deficiency on plant growth. I. Correlative amounts of magnesium, calcium and potassium in the magnesium-deficient plant. Miyazaki U. Facul. Agr. B. 2(1): 30-5. (Japanese).

Mg-deficient symptoms appear when the MgO content of plants is less than 0.15-0.20% in tobacco. The leaves of Mg-deficient plants contain more total CaO and K₂O than the leaves of normal plants. The sums of the chemical equivalents of three cations (Mg, Ca, and K) in the leaves of Mg-deficient plants are not constant. In Mg-deficient tobacco plants, the MgO contents decrease especially in the lower leaves. The K₂O content increases considerably in comparison to normal plants. Mg-deficient symptoms appear when the exchangeable MgO content in soil is less than 10 mg/100 g soil.

BA 33(12): no. 47038, Aug. 20, 1959.

BRYAN, W. H.: Study on the effect of Indole-3-acetic acid on cultured tobacco parenchyma cells. Thesis, Ann Arbor, Mich. Univ. Microfilms L. C. Card No. Mic 59-3172. 1959, 143 p.

Indole-3-acetic acid stimulates increases in both total dry weight and in dry weight of wall materials isolated from homogenates of cultured tissue. It also produces increases in the pectic, holo-cellulose, and lignin fractions. Volume of the isolated wall material is increased. Liquid from the surfaces of enlarging pith discs contains reducing sugars in a higher concentration than that which exists in the medium directly beneath the tissue. Dissociation of several responses of cultured pith to auxin has been achieved by using mannitol to adjust the osmotic concentration of the culture medium. Diphenylamine at 2×10^{-4} M in the culture medium inhibits respi-

ration and prevents the cell enlargement induced by auxin. Inclusion of 6-furfurylamino purine (kinetin) does not result in the cell separation which occurs in tissue cultured on a medium containing only auxin. The effects of auxin on the activities of peroxidase, pectin methylesterase, and ascorbic acid oxidase and on endogenous respiration are accentuated by kinetin. Wall fragments prepared from several plant species and incubated with galactose-1-phosphate and uridine triphosphate catalyze the formation of a substance which appears to be uridine diphosphate galactose. This reaction is believed to be an early step in the production of galactans and polyuronides.

DA 20(3) : 859, Sept. 1959.

Seedling Production :

MIRSKOVSKI, J., 1959 : Usage of total and selective herbicides for controlling weeds in tobacco beds and their effects on the tobacco plants, Duvan 9(10) : 288-307, Oct. illus. tables. (Serbo-Croatian).

In 1955, 1956, 1957, 1958 and 1959, the effects of the following total and selective herbicides, applied at various rates before seeding, were investigated : Sodium chlorate (NaClO_3), Weecide (NaAs_3O_3), TCA ($\text{NaC}_2\text{Cl}_3\text{O}_2$), Ammate ($\text{Na}_2\text{H}_6\text{SO}_4$), Fitoksol (PCP), Crag herbicide 1 (2, 4-dichlorophenoxyethyl sulfate), calcium cyanamide, 2, 4-D and 2, 45-T. Among the total herbicides, Weecide at 2 and 3 cm^3/m^2 20 and 30 days before sowing gave best results, decreasing weeds 42.47% and seedlings 5-15%, as compared to control plots. Other total herbicides were also effective in weed control, but at the same time decreased the number of seedlings. Among the selective herbicides, Fitoksol 15 (PCP) gave effective control and had a positive influence on the number of seedlings. At 6 and 8 cm^3/m^2

20 days before sowing, 17-30% more seedlings and 64-67% less weeds were obtained, compared to control plots. Calcium cyanamide was also effective in controlling weeds without seedling injury when applied under wet conditions at 50 and 100 g/m^2 20 days before sowing. These rates increased seedlings 5-10%, and decreased weeds 67-82%. Deformations on leaves and stalks were caused by direct treatment of tobacco plants with 2, 4D and 2, 45 T at 0.1, 0.25, 0.5, 1.0 and 2.0%. (From English summary).

Varieties :

KLARNER, S.: 1959 : Resistance of Kentucky type tobacco varieties to black root-rot disease (*Thielaviopsis basicola* Ferr.) Roczn. Nauk Roln. Ser. A 79(4) : 1063-75. (Polish).

Comparisons were made on the resistance of varieties and lines of Kentucky type tobacco crosses to *Thielaviopsis basicola* Ferr. *T. basicola* and height of plants, their developments, rate of growth, and period of flowering. This disease decreases the quantity and quality of infected leaves to tobacco varieties susceptible to *T. basicola* as compared to healthy plants. From amongst the most resistant varieties line 1/47 Kentucky 3002 $\times$ Szamoszaty $\times$ Gold Leaf gives low and qualitatively poor yields of raw material, while one 7-5/43 Kentucky 3002 $\times$ Szamoszaty has a long vegetation period, and after fermentation gives a lower quality raw material than Kentucky 3002. (From English summary).

Key to source Abbreviations :

AHEA	Agricultural and Horticultural Engineering Abstracts.
BA	Biological Abstracts.
CA	Chemical Abstracts.
DA	Dissertation Abstracts.
TA	Tobacco Abstracts.

We record with deep regret the sad demise in May last, of Shri R. M. SUNDARAM, I.C.S. who, as the Director of Agriculture, Madras, represented the Department of Agriculture of that State on the Committee during the period 1948-51 and 1952-57 and Shri P. L. TANDON, who, as the Chief Inspector, Tobacco Grading served the Committee from 1945-53.

Shri Sundaram played a major role in giving effect to the Committee's recommendations particularly, in respect of internal marketing of tobacco in Guntur District.

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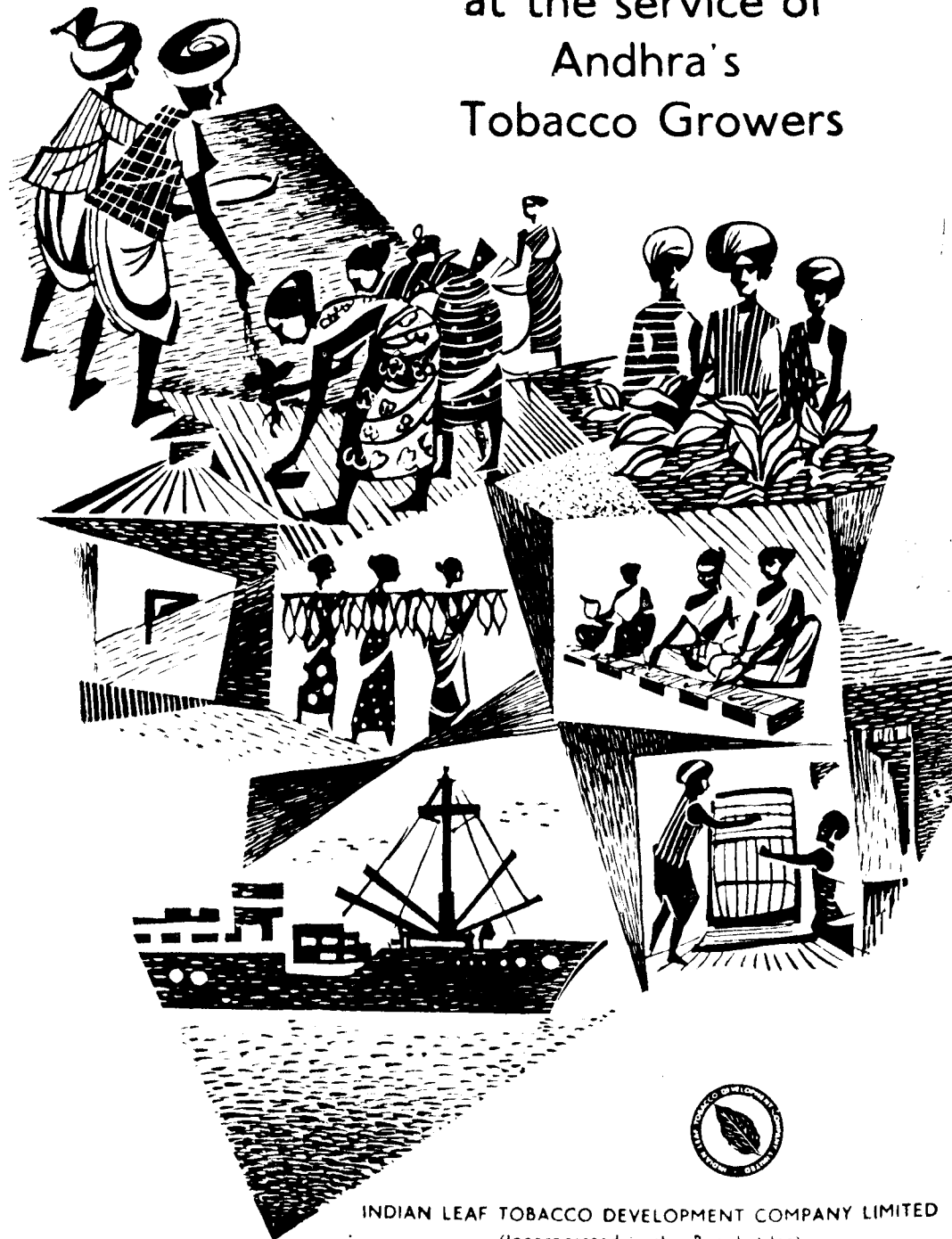
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Printed by T. K. Venkatesan at The Topper Press Private Ltd., 109 C, Mount Road, Madras 18.
Edited and Published by Dr. M. S. Patel, M.Sc., Ph.D., N. Carolina, Secretary, Indian Central Cotton Committee, Madras 1.

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