

Forms and levels of nitrogenous fertilizer for flue-cured tobacco in the dry zone of Ceylon

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(Received April, 1969)

INTRODUCTION

FLUE-cured tobacco is exacting in its nutrient requirements and application of nitrogen which has a marked effect on the growth, yield and quality of the crop produced needs to be carefully adjusted. Inadequate nitrogen results in tobacco low in both yield and quality. An excess of this nutrient tends to retard maturity and produces a cured leaf of undesirable colour, poor texture and other characteristic associated with low quality.

In an attempt to improve the yield and quality of the leaf produced from the irrigated ricelands of the Dry Zone where large acreages are available, studies on nitrogen fertilisation have been carried out. The need to improve the quality of the leaf produced from these tracts have recently become further important consequent to some of the better tobaccos produced from the limited land in the hill country of the Island being utilised to meet the requirements of the export market. As the domestic requirements of flue-cured tobacco are also progressively increasing the cultivation of this crop is being extended into areas of the Dry Zone.

PRELIMINARY TRIALS

Preliminary trials were carried out with the variety Harrison's Special in Maha 1960-61, Yala 1961 Yala 1962 to study the relative efficiency of 3 different nitrogenous fertilisers, viz: ammonium sulphate, ammonium sulphate nitrate and ammophos (16 per cent. N, 40 per cent. P_2O_5 at varying levels of nitrogen.

In Maha 1960-61 the experiment was carried out under upland conditions at the Agricultural Station, Hingurakgoda and the 3 forms of nitrogen were tried at 15 lbs. and 30 lbs. per acre rates. All the fertilisers were applied at the time of planting. The variety used in these experiments was Harrison's Special.

Table I shows the cured leaf yield for the various treatments. The data demonstrate that fertilisation improves yield significantly over no fertilisation. At 15 lbs. nitrogen per acre rate amophos was superior to ammonium sulphate and ammonium sulphate nitrate, though at the higher level ammonium sulphate nitrate was better. The mean difference in yield for the two levels of nitrogen was, however, not significant.

The experiment was repeated at the same station in a riceland during the 1961 Yala season. In this experiment the results (table 2) showed that 30 lbs. nitrogen per acre in all the 3 forms tried was significantly superior to 15 lbs. nitrogen per acre. The results also indicated that amophos and ammonium sulphate nitrate increased the yields significantly over ammonium sulphate. At 15 lbs. nitrogen per acre only amophos was significantly superior to no fertilisation.

It is evident from the results of the above two experiments that flue-cured tobacco production in these tracts is more profitable when grown as an irrigated Yala crop in the ricelands than as a Maha crop under upland conditions, provided the quality of the leaf produced is acceptable in manufacture. Subsequent trials were, therefore, carried out in the Yala seasons.

In Yala 1962 a similar experiment was carried out in which the effects of split application of the fertiliser was also studied. The split application treatment consisted of half the fertiliser being applied at the time of planting followed by a top dressing of the balance half 3 weeks later.

This trial was sited at two locations, viz. Agricultural Station, Hingurakgoda and Agricultural Station, Malwatte (Gal Oya) and the data obtained for the two locations are presented in tables 3 and 4. The yield responses for 15 lbs. and 30 lbs. nitrogen per acre were not significantly different at both the locations. The difference in yield between the 3 fertiliser forms and the 2 methods of application were also non-significant at both levels.

NITROGENOUS FERTILIZER FOR FLUE-CURED TOBACCO

MAIN EXPERIMENT

After this preliminary work further research using the variety White Gold which is the most acceptable variety to the cultivators among the three varieties found to be superior to Harrison's Special was carried out in Yala 1966 (1). In view of the higher responsiveness of this variety of nitrogen over Harrison's Special the levels of nitrogen were modified and the experiment was carried out in Yala, 1967.

Urea is becoming increasingly important as a nitrogenous fertiliser with the replacement of ammonium sulphate by this for rice in many parts of the Island (2). In view of this, the economies of its usage and the prospects of this fertiliser being manufactured in this country, it was also included in the trial along with ammonium sulphate, ammonium sulphate nitrate and ammophos.

MATERIALS AND METHODS

The experiment was located at the Agricultural Station, Hingurak-goda in a well drained riceland. The soil was a sandy loam.

Previous Crops and Fertilisers used

Season	Crop	Fertiliser applied (lbs./acre)						Total
		Ammonium sulphate	Sapthos phosphate	Muriate of potash	Conc. phosphate	Super phosphate	Sulphate of potash	
Yala, 1964..	Paddy (H-4)	224 ..	112 ..	56 ..	— ..	— ..	— ..	392
Maha, 64/65	Paddy (H-4)	224 ..	112 ..	56 ..	— ..	— ..	— ..	392
Yala, 1965..	Cigarette Tobacco ..	100 ..	— ..	— ..	200 ..	150 ..	— ..	450
Maha, 65/66	Paddy (H-4)	224 ..	112 ..	56 ..	— ..	— ..	— ..	392
Yala, 1966..	Paddy (H-4)	224 ..	112 ..	56 ..	— ..	— ..	— ..	392
Maha 66/67	Paddy (H-4)	224 ..	112 ..	56 ..	— ..	— ..	— ..	392
Total ..		1220	560	280	200	150		2410

Treatments

A. Forms of Nitrogen

Ammonium sulphate (20%N)	—F1 ..	0 lb. Nitrogen per acre	—N0
Ammonium sulphate nitrate (26%N)	—F2 ..	20 lbs. Nitrogen per acre	—N1
Ammophos (16%N&40% P2O5)	—F3 ..	40 lbs. Nitrogen per acre	—N2
Urea (43%N)	—F4		

B. Levels of Nitrogen

Design : 4 x 2 factorial with control, having 3 replicates

Block size : 135' x 30'

Plot size : 15' x 30' (5 rows of 12 plants at a spacing of 3' x 2½'. The net harvested area after leaving a border row of one plant all round was 30 plants—1/200-acre)

The plots received a uniform application of concentrated superphosphate (42 per cent. P_2O_5) at 200 lbs. per acre rate (adjustment was made in case of ammophos treatment) and sulphate of potash (48 per cent. K_2O) at 125 lbs. per acre rate along with the different nitrogen treatments as a basal dose at the time of planting. On 16.5.1967 uniform 6 weeks old seedlings were transplanted on ridges. The crop was given 6 irrigations after planting. Standard cultural and curing practices were followed.

RESULTS

The weights of the cured leaf according to grade from the different treatments were recorded and valued on the basis of the prices fixed for the grades for the year 1967. The data are presented in tables 5 and 6.

The results clearly indicate that there is significant response in terms of yield and monetary returns per acre for nitrogen fertilisation over no-fertilisation. There was no significant difference between the different fertiliser forms.

DISCUSSION

The results obtained from the experiment firstly indicate that applications of nitrogen at 20 lbs. per acre has a marked effect on the growth and development of the crop resulting in significantly higher value per acre over no-fertilisation. This is supported by the findings in an earlier experiment carried out at the same station (1). It is also shown that application of 40 lbs. nitrogen has distinctly depressed the quality of the leaf produced, thereby giving a lower value per acre. This is quite understandable because it is well known that in cigarette tobacco the quality of leaf is inversely related to the level of leaf nitrogen which is conditioned by the nitrogen fertility of the soil. Gopinath (3) on a study of NPK fertilisation of flue-cured tobacco in the fertile soils of Andhra Pradesh has reported that more than 20 kg/ha nitrogen was detrimental to leaf quality.

In regard to the different sources of nitrogen, the main experiment (Yala 1967) has shown that there is no significant difference between ammonium sulphate, ammonium sulphate nitrate, ammophos or urea in terms of the market value of the crop, although ammophos has given the highest yield of cured leaf in this trial as in the preliminary trials. Therefore, the use of urea for the fertilisation of cigarette tobacco cultivated as a Yala crop especially under the environmental conditions of Hingurakgoda appears feasible. Massantini and Favilli (4) have reported that urea form of nitrogen appears to perform well on

NITROGENOUS FERTILIZER FOR FLUE-CURED TOBACCO

tobacco and that quality characteristics responded similar to yield. Atkinson (5) working on uramite, a synthetic nitrogenous fertiliser material, has found that for burley tobacco this fertiliser at equivalent amounts of nitrogen did not differ in yield or value in relation to ammonium nitrate. Jungermann (6) has reported that tobacco does not react unfavourably to urea (biuret content 4.7 per cent.). It would, therefore, appear that ammonium sulphate can suitably and be replaced by urea as a nitrogenous fertiliser for flue-cured tobacco under conditions obtaining in the Dry Zone of Ceylon.

SUMMARY AND CONCLUSIONS

A number of experiments were conducted at Hingurakgoda (Polonnaruwa District) and at Malwatte (Gal Oya Valley) over a number of years to study the responses of flue-cured tobacco to fertiliser nitrogen in different forms. The results obtained from these studies permit the following conclusions:—

1. On the basis of equivalent amounts of nitrogen, ammonium sulphate, ammonium sulphate nitrate, ammophos and urea did not significantly differ from each other in respect of the yield, quality and value of the leaf produced. Therefore, urea which is likely to be produced locally in the near future and which is being used extensively for fertilising rice could be considered suitable for use in flue-cured tobacco.
2. From the point of view of yield, flue-cured tobacco is more profitable to the farmer when grown as an irrigated Yala crop, provided the quality of the leaf produced is acceptable in manufacture and trade.
3. The income per acre is higher under conditions at Hingurakgoda than at Gal Oya. The lands in the former area are evidently richer.
4. Application of inorganic nitrogen at 20 lbs. per acre increased yield and improved leaf quality over the no-nitrogen treatment.
5. The optimum level of nitrogen under Hingurakgoda conditions would be 20 lbs. per acre whereas for Gal Oya higher doses of nitrogen may be desirable.
6. Application of all the nitrogen at the time of planting seems satisfactory at Hingurakgoda. Further studies in this respect are necessary for Gal Oya.

ACKNOWLEDGEMENTS

Our thanks are due to Messrs. K. H. N. S. Seneviratne and the late A. Ratnayake Farm managers Hingurakgoda and Malwatte respectively for providing the necessary facilities during the trials. We are also thankful to Mr. V. Navaratnam and Miss S. Shanmugam, Statisticians for their assistance in the analysis of the results.

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NITROGENOUS FERTILIZER FOR FLUE-CURED TOBACCO

TABLE I.—Effects of different forms and levels of nitrogen on the cured leaf yield of flue-cured tobacco in Maha, 1960-61 at Hingurakgoda—(lbs. per acre)

			<i>Am. Sulphate</i>		<i>Am. sulphate nitrate</i>		<i>Ammophos</i>		<i>Mean</i>
0 lb. N/ac.	..	..	—	..	—	..	—	..	397
15 lbs. N/ac.	..	..	487	..	450	..	615	..	517
30 lbs. N/ac.	..	..	484	..	662	..	562	..	569
Mean	..	..	484	..	556	..	588	..	—

L. S. D. (5%) 76.2

O. V. 14.62%

TABLE II.—Effects of different forms and levels of nitrogen on the cured leaf yield of fluecured tobacco in Yala, 1961 at Hingurakgoda—(lbs. per acre)

			<i>Am. sulphate</i>		<i>Am. sulphate nitrate</i>		<i>Ammophos</i>		<i>Mean</i>
0 lbs. N./ac.	..	..	—	..	—	..	—	..	1404
15 lbs. N./ac.	..	..	1520	..	1538	..	1616	..	1558
30 lbs. N./ac.	..	..	1741	..	1900	..	1970	..	1870
Mean	..	..	1630	..	1719	..	1793	..	—

L. S. D. (5%) 137.6

O. V. 5.17%

TABLE III.—Effects of different forms, levels and split application of nitrogen on the cured leaf yield of fluecured tobacco in Yala, 1962 at Hingurakgoda—(lbs. per acre)

	<i>Am. sulphate</i>		<i>Ammonium sulphate nitrate</i>		<i>Ammophos</i>		<i>Mean</i>	
	<i>Single Appln.</i>	<i>Split Appln.</i>	<i>Single Appln.</i>	<i>Split Appln.</i>	<i>Single Appln.</i>	<i>Split Appln.</i>	<i>Single Appln.</i>	<i>Split Appln.</i>
0 lb. N./ac.		2162		1687		1825		1891
15 lbs. N./ac.	.. 1800	.. 2237	.. 2312	.. 2350	.. 2037	.. 1912	.. 2049	.. 2166
30 lbs. N./ac.	.. 2412	.. 1977	.. 1925	.. 2075	.. 2050	.. 2325	.. 2129	.. 2125
Mean	.. 2106	.. 2107	.. 2118	.. 2212	.. 2043	.. 2118		

L. S. D. NS.

O. V. 13.82%

TABLE IV.—Effects of different forms, levels and split application of nitrogen on the cured leaf yield of flue-cured tobacco in Yala 1962 at Malwatte (Gal-Oya)—(lbs. per acre)

	<i>Amsulphate</i>		<i>Amsulphate nitrate</i>		<i>Ammophos</i>		<i>Mean</i>	
	<i>Single Appln.</i>	<i>Split Appln.</i>	<i>Single Appln.</i>	<i>Split Appln.</i>	<i>Single Appln.</i>	<i>Split Appln.</i>	<i>Single Appln.</i>	<i>Split Appln.</i>
0 lb. N./ac.	525		712		562		599	
15 lbs. N./ac.	600	1012	712	1075	750	962	687	1016
30 lbs. N./ac.	987	900	825	987	962	925	924	937
Mean	793	956	768	1031	856	943		
L. S. D. 5% 256								
C. V. 22.44%								

TABLE V.—Effects of different forms and levels of nitrogen on the cured leaf yield of flue-cured tobacco in Yala, 1967 at Hingurakgoda (lbs. per acre)

	<i>Ammonium sulphate</i>	<i>Ammonium sulphate nitrate</i>	<i>Ammophos</i>	<i>Urea</i>	<i>Mean</i>
0 lb. N./ac.	—	—	—	—	914
20 lbs. N./ac.	1320	1326	1416	1408	1367
40 lbs. N./ac.	1145	1185	1283	1160	1193
Mean	1233	1255	1349	1284	
L. S. D. 5% 459					
C. V. 8.64					

TABLE VI.—Effects of different forms and levels of nitrogen on the value of flue-cured tobacco in Yala 1967 at Hingurakgoda (Rs. ' per acre)

	<i>Ammonium sulphate</i>	<i>Ammonium sulphate nitrate</i>	<i>Ammophos</i>	<i>Urea</i>	<i>Mean</i>
0 lb. N./ac.	—	—	—	—	2289
20 lbs. N./ac.	3455	3265	3483	3373	3394
40 lbs. N./ac.	2922	2809	3112	2862	2926
Mean	3188	3037	3297	3117	
L. S. D. } 5%—459					
} 1%—632					
C. V. 8.64%					