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A COMPARATIVE STUDY OF STANDARD AND HIGH ANALYSIS FERTILIZER MIXTURES FOR TOBACCO

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SUMMARY

During the three seasons 1966 to 1968, responses to a high analysis fertilizer and a standard mixture were compared in flue-cured tobacco in north Queensland. Both fertilizers were applied at two application levels and compared as single or split dressings. Responses in terms of yield and/or leaf quality favoured the standard fertilizer mixture in two of the three years. One planting fertilizer application compared favourably with two split applications 5–6 weeks apart.

I. INTRODUCTION

Since the mid-1960s two types of fertilizer mixture have been commercially available for use on flue-cured tobacco in north Queensland. These can be described as standard and high analysis fertilizers. The former supply nitrogen predominantly as nitrate, and the phosphorus as single superphosphate (9·6% P). By comparison, the more soluble high analysis fertilizers supply nitrogen and phosphorus predominantly as ammonium phosphate. Potassium in both the standard and high analysis fertilizers is supplied as potassium sulphate.

Manufacturing trends in fertilizer mixtures have been towards an increase in the concentration of nitrogen, phosphorus and potassium. Terman and Silverberg (1958) noted that in the United States high analysis mixtures contained on the average from 30% to nearly 80% more plant nutrients (N, P and K) than did mixed fertilizers. By using high analysis fertilizers, reductions in handling, bagging and transport costs could be achieved.

II. METHODS AND MATERIALS

Field studies commenced in 1966 were continued in 1967 and 1968 comparing a standard fertilizer with a high analysis mixture. Fertilizers used were:

(1) Standard mixture: 3% N as sodium potassium nitrate, 5·5% P as single superphosphate (9·6% P) and 12·5% K mainly as potassium sulphate.

(2) High analysis mixture: 6% N and 7% P predominantly as ammonium phosphate and 25% K as potassium sulphate.

(3) High analysis mixture, as above, with additional single superphosphate (9·6% P).

The third treatment was included to equate the phosphorus level of the high analysis mixture with that of the standard fertilizer.

In 1966 fertilizers were applied at a level equivalent to 20 lb N/ac and either all added basally or split into two equal applications approximately 5 weeks apart. In 1967 and 1968 split applications were again compared, while two levels of application (equivalent to 20 and 30 lb N/ac) were also examined. A factorial design was used in each season incorporating 3 replications in 1966 and 1968 and 4 replications in 1967.

These studies were conducted on the Departmental Research Station in the Mareeba–Dimbulah area of north Queensland. The soil type used was a Dimbulah sandy loam consisting of a sandy loam (0–15 in.) overlying a gritty clay loam. Tobacco (cv. Hicks, Q34) was transplanted in mid September of each year following 2 years of Rhodes grass (*Chloris gayana* Kunth). Normal cultural practices were followed each season. Rainfall during the main growing period (September–December) varied appreciably between seasons and totalled 3·1 in., 7·4 in. and 0·9 in. during 1966, 1967 and 1968 respectively. An 8-year average rainfall for the same months (September–December) totalled 7·2 in. Plots comprised a single row of 26 and 25 plants in 1966 and 1967 respectively, while in 1968, two rows each of 22 plants were used. Cured leaf yields were recorded and quality index was assessed per harvest with points being allocated for colour, elasticity, grain and maturity. An overall measure of leaf quality was obtained from the summation of weighted quality indices per plot. The combination (yield x quality index) was then used as a measure of overall crop performance or productivity index.

III. RESULTS

Data obtained in each season are discussed separately and the results presented in Table 1.

1966-67 *season*.—The standard fertilizer gave the most satisfactory performance for those factors examined when the level of fertilizer application was equivalent to 20 lb N/ac. With the standard fertilizer yield was significantly higher ($P<0·05$) than that obtained from either of the other two fertilizer mixtures. Although differences in quality index and productivity index were generally not significant, in each instance the standard fertilizer gave the highest values. Splitting of fertilizer mixtures into half applied preplanting and half applied 35 days after transplanting tended to give a lower yield, lower quality index and lower productivity index than a single preplant application. Differences, however, were not significant. Interactions of fertilizer mixture x time of application showed no significant trends in any season and consequently have not been quoted.

1967-68 *season*.—During the second season, the same fertilizer mixtures were compared but applied at two different levels, equivalent to 20 and 30 lb N/ac. As in the previous season, fertilizer applications were compared either as one single dressing or two equal applications approximately 6 weeks apart. The standard fertilizer produced a higher yield, higher quality index and higher productivity index than the high analysis mixture. In this season the high analysis mixture with added superphosphate gave responses intermediate between the standard and the high analysis treatments. There was a response to the split application of fertilizers which resulted in a significant increase ($P<0·05$) in the productivity index. This response to split fertilizer applications could probably be attributed to the rainfall received in October (1·8 in., compared with only 0·4 in. and 0·2 in. in October of the 1966-67 and 1968-69 seasons respectively). No favourable response was obtained by raising the level of nutrition from the equivalent of 20 lb to 30 lb N/ac.

TABLE 1

TOBACCO CURED LEAF ASSESSMENT

	1966–67			1967–68			1968–69		
	Yield (lb/ac)	Quality Index	Productivity Index*	Yield (lb/ac)	Quality Index	Productivity Index*	Yield (lb/ac)	Quality Index	Productivity Index*
Fertilizer									
(1) Standard	1,767	50·3	89·0	1,675	35·0	58·2	1,942	36·1	70·2
(2) High analysis	1,503	50·0	75·5	1,554	32·1	50·3	1,839	35·5	65·5
(3) High analysis + superphosphate	1,501	47·8	71·9	1,629	33·1	53·9	1,715	33·9	58·6
S.E.	64·1	1·2	4·5	46·1	0·9	2·1	34·6	0·8	2·1
Necessary differences for significance 5%	202	3·9	14·1	133	2·5	5·9	103	2·3	6·2
Necessary differences for significance 1%	287	5·5	20·0	178	3·4	7·9	141	3·1	8·5
Time of Fertilizer Application									
(a) All preplant	1,610	49·6	80·1	1,576	32·5	51·5	1,899	36·2	69·1
(b) ½ pre- + ½ post-plant	1,571	49·2	77·4	1,663	34·2	56·7	1,765	34·2	60·4
S.E.	52·3	1·0	3·6	37·7	0·7	1·7	28·3	0·6	1·7
Necessary differences for significance 5%	165	3·2	11·5	108	2·1	4·8	84	1·9	5·1
Necessary differences for significance 1%	234	4·5	16·3	146	2·8	6·5	115	2·5	6·9
Rate of N Application									
(i) 20 lb N/ac				1,653	33·1	54·8	1,799	34·2	61·9
(ii) 30 lb N/ac				1,586	33·7	53·5	1,865	36·2	67·5
S.E.				37·7	0·7	1·7	28·3	0·6	1·7
Necessary differences for significance 5%				108	2·1	4·8	84	1·9	5·1
Necessary differences for significance 1%				146	2·8	6·5	115	2·5	6·9

* Productivity index (x 10^3).

1968-69 *season*.—As in the previous season two application levels (equivalent to 20 and 30 lb N/ac) were compared as either one single or two equal dressings approximately 6 weeks apart. The results indicated that the standard mixture gave the highest yield and enhanced quality index slightly, although differences were not significant. In this season the addition of superphosphate to the high analysis fertilizer was of no advantage and resulted in the lowest yield and lowest productivity index. In comparing the two levels of fertilizer (20 and 30 lb N/ac) the higher level increased yield, quality index and productivity index. Differences were significant at the 5% level for quality and productivity indices. Split fertilizer applications gave a lower response than the single application.

IV. DISCUSSION

It is concluded, on the basis of overall performance, that the standard fertilizer mixture would give a more consistent response over a period of years than the high analysis fertilizer. No explanation can be offered for the less favourable response to the high analysis mixture, although the higher solubility and the all-ammonium source of nitrogen of the high analysis mixture may have had some effect on the responses obtained. The addition of superphosphate to the high analysis fertilizer was of no advantage, indicating that phosphorus was not limiting.

Increasing the level of fertilizer in the second and third seasons gave a significant response only in the quality index in the 1968-69 season. This limited response indicated that the difference between levels was insufficient to produce any marked effects. Responses to the number of fertilizer applications (either one single or two equal dressings) varied slightly, depending on the season. In general, it would appear that either one single basal application or two split applications 5–6 weeks apart would be equally effective under most conditions.

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