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INFLUENCE OF COMPLEX FERTILIZERS ON THE YIELD AND YIELD COMPONENTS OF RICE

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Studies were made to determine the efficiency of nitrophos German, nitrophos Norwegian and slow-release urea as compared with ammonium sulphate, urea and di-ammonium phosphate as applied to rice variety Basmati 370 in a normal sandy clay loam soil. Two doses of fertilizers, 60 and 90 lbs/acre of nitrogen, were used while the same level of phosphorus was maintained. The highest paddy yield was obtained with the slow-release urea followed by nitrophos German, di-ammonium phosphate, urea, nitrophos Norwegian and ammonium sulphate in that order, respectively. The slow-release urea also produced highest straw yield, tillering and head rice recovery.

INTRODUCTION

At present various straight or single nutrient fertilizers and their mixtures are being used in rice culture. Usually, all these fertilizers are not available at an easily accessible place and at one time. Therefore, very often the farmers miss the use of one or the other important nutrient badly needed by them crops, and thus resulting in only partial benifit to their crops. Also, when the straight fertilizers were mixed manually by the farmers, they do not form homogeneous mass with the result that the crops receive an uneven and often unbalanced distribution of nutrients.

Such situation suggests partial switching over to the use of complex fertilizers which supply more than one nutrient in the right proportion from the same prill or granule. Two complex fertilizers Nitrophos (23-23-0) and Nitrophos (20-20-0) manufactured by Norway and Germany, respectively, have been introduced in our country. There are feelings that the agronomic value of high-analysis fertilizers may be low because of leaching, decomposition, luxury consumption and possible toxicity due to heavy applications. These losses could be minimized by controlling the release of nutrients and for this sulphur coated urea named as slow-release urea has been introduced. It is

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important to test their relative efficiency against the conventional fertilizers and fertilizers mixtures. The present study was a step in that direction.

MATERIALS AND METHODS

The treatments consisted of two doses of nitrogen (60 and 90 lbs N/acre) of each of the six sources, ammonium sulphate, urea, slow-release urea, nitrophos Norwegian, nitrophos German and di-ammonium phosphate. In all the treatments the P_2O_5 level was maintained equal to the nitrogen level for which purpose superphosphate was added along with ammonium sulphate, urea and slow-release urea. Nitrophos (Norwegian and German) and di-ammonium phosphate were provided no additional source of phosphorus. In di-ammonium phosphate, to maintain the nitrogen level, ammonium sulphate was added. Thus, there were, in all thirteen treatments including the control. The soil was sandy clay loam. The chemical composition of 0–6" surface layer was : pH, 7.6, EC, 2.2 mmhos/cm., T. S. S., 22.0 me/L.. Nitrogen 0.065%, available phosphorus, 10.0 ppm., and organic matter, 0.85%.

The experiment was laid out in a randomized complete block design with 4 repeats. The net plot size was 1/73 the of an acre. The data were subjected to the analysis of varience, and Duncan's multiple range test was employed to determine the significance of differences.

The field was thoroughly ploughed and the fertilizers were broadcast and mixed in each plot when dry. The plots were then flooded and the nursery of Basmati 370 was transplanted in the field on July 27, 1970. The plots were kept flooded with canal water with only occasional drying in-between two water turns, particularly when weather was hot and dry. When the crop matured, tillering of plants was recorded from three 36" × 36" samples in each plot. The crop was harvested on November 10, 1970, and threshed manually. The yield of paddy and straw were recorded for each plot separately. The composite samples of paddy were taken from the produce heap of each plot, air-dried and the yield of paddy calculated on the dry-weight basis. The air-dried samples were husked in the McGill sheller and head rice percentage was determined in the husked rice.

RESULTS AND DISCUSSION

The results presented in Table 1 reveal that the yield of paddy was increased by 13.23 to 57.62% and straw by 15.89 to 70.48% over the control by various fertilizers. The higher dose of fertilizers resulted in a higher yield as compared to the lower dose. Slow-release urea (90 lbs/acre) produced significantly higher yield of paddy as compared to all other treatments. Next to slow-release urea was nitrophos German, when nitrogen was applied at the rate of 90 lbs per acre and in the same dose the other sources in their descending order were urea, di-ammonium phospoate+ammonium sulphate, nitrophos Norwegian and ammonium sulphate, respectively. With the nitrogen applied at the rate of 60 lbs per acre the slow-relsase urea produced the highest yield which was even higher than all other sources applied at the rate of of 90 lbs N/acre. The next higher yield of paddy (when 60 lbs N/acre was applied) was in the case of nitrophos German and was followed by di-ammonium phosphate+ammonium sulphate, urea, ammonium sulphate and nitrophos Norwegian in the decreasing order of paddy yield, respectively. The lowest yield was recorded for the control.

The highest straw yield was observed for the slow-release urea applied at the rate of 90 lbs N/acre and the next higher straw yield was obtained for urea (90 lbs N/acre). This was followed by 60 lbs N/acre as slow-release urea and 90 lbs N/acre as nitrophos German (both had given nearly equal straw yields). The sources in their generalized effect, ranked as follows: slow-release urea, urea, nitrophos German, nitrophos Norwegian, diammonium phosphste+ammonium sulphate and ammonium sulphate. The lowest straw yield was obtained for the control.

The slow-release urea was efficient for rice growing as compared with complex fertilizer (Rindt *et al.*, 1968., and Ahmad *et al.*, 1969). The low efficiency of the complex fertilizers could be attributed to the nitrate portion of nitrogen that is readily subjected to leaching and denitrification (Anderson *et al.*, 1946, and Wahab and Bhatti, 1957). Complex fertilizers are as effective or in some cases more effective than equivalent mixtures of straight fertilizers (Churkin and Pazdnikov, 1969., Bhatti *et. al.*, 1970-71., and Chaudhry and Khanzada, 1970).

The number of tillers per plant (Table 2) ranged from 14.4 to 62.3 per cent over the control. Moreover, tillering significantly increased with the application of the higher doses of fertilizers as compared with the lower doses. Similar results were reported by Irri, 1964, 1967., and Terman *et. al.*, 1970. Sources of nitrogen showed marked variations in tillering. Slow-release urea induced significantly more tillering as compared to other sources. Urea, di-ammonium phosphate+ammonium sulphate and both nitrophos were statistically non-significant. However, urea and di-ammonium phosphate+

ammonium sulphate significantly increased the tillers as compared to ammonium sulphate.

TABLE 1. *Effect of fertilizers on the yield of the rice variety basmati 370 averaged over repeats.*

Sources of nitrogen	Doses per acre	Paddy yield lbs/acre	Per cent increase over control	Straw yield lbs/acre	Percent increase over control
Control	—	1791	100.00	2070	100.00
Ammonium sulphate	60	2039	114.95	2399	115.89
" "	90	2447	125.45	2765	133.59
Urea	60	2231	124.62	2761	133.38
"	90	2479	139.42	3295	159.13
Nitrophos Norwegian	60	2028	113.23	2484	129.66
" "	90	2416	134.89	2771	133.86
Nitrophos German	60	2248	131.10	2669	128.93
" "	90	2580	144.05	3137	151.54
Slow-release urea	60	2662	148.63	3144	151.88
" "	90	2823	157.62	3529	170.48
Di-ammonium phosphate+ammonium sulphate	60	2335	130.37	2601	125.65
" "	90	2438	136.12	2828	136.61

Paddy yield was recorded at 9% moisture level.
Straw yield was on the oven-dry basis.

TABLE 2. *Yield components as affected by fertilizers.*

Sources of nitrogen	Doses per acre	Tillers per plant	1000 kernel weight in gm	Head rice recovery per cent by weight
Control	—	7.48	14.62	50.25
Ammonium sulphate	60	8.56	14.92	52.95
" "	90	8.89	14.98	55.10
Urea	60	7.29	14.83	53.22
"	90	11.02	15.07	59.05
Nitrophose Norwegian	60	8.60	14.77	52.05
" "	90	9.87	15.07	57.25
Nitrophos German	60	8.95	15.03	53.67
" "	90	10.10	15.09	55.90
Slow release urea	60	10.62	15.14	56.15
" "	90	12.14	15.16	59.79
Di-ammonium phosphate +ammonium sulphate	60	9.63	14.89	51.97
" "	90	10.32	15.00	55.12

The 1000-kernel weight (Table 2) showed an increasing trend with the application of fertilizers especially at the higher doses as compared to the control, indicating better development of grains. However, the increase in 1000-kernel weight was not statistically significant within the two doses, i.e., 60 and 90 lbs each of N and P_2O_5. The sources also did not exhibit significant variation among themselves with regard to 1000-kernel weight. Place *et al.*, (1970) reported the similar effects.

The results (Table 2) show that head rice percentage was low in unfertilized plots and the application of fertilizers resulted in a significant increase (3.6 to 18.9% over control). A higher percentage of head rice resulted from the higher doses of fertilizers. Place *et al*, (1970) reported that the head rice percentage was reduced by the application of nitrogen and phosphorus, attributable to the adverse effect of lodging. Slow-release urea resulted in a significantly higher head rice recovery as compared to all other sources except urea. All other sources except slow-release urea had no significant differences among themselves.

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