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RESPONSE OF UPLAND RICE TO NITROGEN AS INFLUENCED BY BULK DENSITY OF SOIL

Upland rice soils are neither submerged nor saturated with water for any appreciable part of the growing season. Aerobic environment of those soils favours rapid oxidation of the applied ammonical fertilizers into nitrates. Nitrates, however, are easily lost by leaching. This results in lower rate of plant uptake. Compaction of soil is considered to minimise cuch losses and increase nutrient uptake by plants (Patnaik *et al.*, 1968). There is however' a critical bulk density beyond which growth of root and shoot is adversely affected due to high mechanical strength of the soil (Childyal, 1971). The present study was undertaken to assess the response of upland rice to nitrogen as influenced by the bulk density of the soil.

The investigation was conducted during the 'virippu' season (May-September) of 1970, 1971 and 1973 in the rainfed 'modan' uplands of the Rice Research Station, Pattambi. The soil of the experimental area was a lateritic sandy loam of low fertility (organic carbon 0.45%: available P_2O_5 9 7 kg/ha: available K_2O 127.4 Kg/ha; Ph 5.8). The treatments comprised of 3 degrees of soil compaction (bulk density 1.200, 1.260, 1.318 g/cc) and 3 levels of nitrogen (0,40,80 kg/ha). The design of the experiment was split plot wiih compaction as major treatment and nitrogen as minor treatment. There were 8 replications. All the plots received uniform doses of P_2O_5 and K_2O t 40 k each hectare before seeding. Nitrogen was applied in 2 equal splits at seeding and at panicle initiation. The seeds were dibbled at a spacing of 15 cm × 15 cm adopting a seed rate of 80 kg/ha. Compaction of the soil to 1.260 and 1.318 g/cc was achieved by running stone rollers weighing 80 d 330 kg, respectively, immediately after seeding. The bulk density of the soil before compaction was 1.200 g/cc.

Compaction of the soil resulted in remarkable increase in grain yield in all the 3 seasons, although the difference between the degrees of compaction touched the level of statistical significance in 1973 only (Table 1). Increasing the bulk density of the soil from 1.200 g/cc (control) to 1.318 g/cc by compac ing the soil wi'h the heavy roller brought about an yield increase of 19.7 per cent in 1970, 20.3 per cent in 1971 and 43.4 per cent in 1973 over the control. Compaction with the light roller (1.260 g/cc) recorded 23.5, 11.0 and 10.8 per cent increase in yield over the uncompacted plot during the respective seasons, indicating that even a slight increase in bulk density had the desirable effect on the upland rice crop.

Table 1

Grain yield corresponding to varying balk **density** of **soil** and nitrogen.

Year	Bulk density of soil (g/cc)				Nitrogen (kg/ha)			
	1.200	1.260	1.318		0	40	80	(0.5
1970	1177	1450	1406		617	1451	1965	304
1971	.1655	1835	1989		1120	2017	2339	272
1973	793	877	1004	90	537	709	1428	141
Mean	1208	1387	1466		758	1392	1911	314

Table 2

Response of rice to **nitrogen** as **influenced** by soil **compaction** (mean grain yield of 3 **seasons)**

Nitrogen (kg/ha	Bulk density of soil (g/cc) 1.200	1.260	1.318	Mean
0	699	111	802	758
40	1213	1432	1532	1392
80	1716	1953	2064	1911
Mean	1208	1387	1466	

Response to nitrogen was linear and significant with the 80 kg/ha level consistently recording the highest yield. The magnitude of response to applied nitrogen at 80 kg/ha was 16.8, 15.2 and 11.1 kg of grain per kg of nitrogen in 1970, 1971 and 1973, respectively. However, the rate of response was relatively higher for the 40 kg/ha level in 1970 and 1971.

At all the levels of nitrogen, an increase in the bulk density of soil enhanced grain production to an appreciable extent (Table 2). The interactional effects were, however, significant in none of the seasons. Compaction of the soil might have resulted in greater water retention owing to breaking down of macropores into micropores thereby reducing noncapillary porocity. The results

clearly indicated that rice yields in the rainfed marginal uplands could be increased substantially by applying 80 kg N/ha and compacting the soil to a bulk density of 1.318 g/cc after seeding.

സംഗ്രഹം

വിത്തു് വാരിയിട്ടശേഷം 'രോടൻ' നിലങ്ങളിലെ മണ്ണു് സംഹനനം ചെയ്യുന്നതു് (സ്ഥൂലഘനത്വം: **1.318** ഗ്രാം/സി. സി.) ഉല്പാദന വർദ്ധനവിനു് പ്രേരകമായ ഒരു കൃഷിപ്പണിയാണെന്നു് പട്ടാമ്പിയിലെ നെല്ല ഗവേഷണ കേന്ദ്രത്തിൽ നടത്തിയ പരീക്ഷണങ്ങളിൽ അനുവേപ്പെട്ട. സംഹനനം മൂലം നെല്ലിന്റെ പാകൃജനകത്തോടുള്ള പ്രതികരണം വർദ്ധിക്കുന്നതായും ഈ പരീക്ഷണങ്ങളിൽ കാണുകയുണ്ടായി.

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