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Integrated input management for groundnut: Groundnut cropping system

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Abstract
Field experiments were conducted at farmer's field, Chinnakottakuppam village, Tamilnadu to study the effect of integrated nutrient management on the productivity of groundnut (kharif)-groundnut (rabi) cropping systems. The results indicated that incorporation of pressmud compost significantly improved the productivity of groundnut-groundnut cropping system. Similarly, application of 100% recommended N and P recorded better growth, yield attribute and yield of kharif groundnut whereas, application of 100 and 75 per cent recommended N and P to the kharif groundnut resulted in higher growth, yield contributing character and pod yield of succeeding rabi groundnut. Regarding biofertilizers treatments, inoculation of biofertilizers had positively influenced the growth and yield of groundnut-groundnut cropping system.

Keywords: Groundnut-groundnut cropping system, organic manures, N and P levels, biofertilizers

Introduction
Groundnut is a premier oil seed crop of India and it cultivated in rainy season (kharif) followed by winter season (rabi) and summer season. Intensive groundnut cultivation largely requires use of chemical fertilizer, even though they are expensive besides short supply and rapid increasing its cost. Sustainable high level productivity of groundnut, the seasonal nutrient depletion must be adequately replenished. The use of chemical fertilizers is probably the easiest means of counteracting the pace of nutrient depletion, which leads to deficiencies of other nutrients, environmental degradation thereby affecting the sustainability of groundnut production. Under such conditions, adoption of an appropriate integrated manuring technique not only improves the crop yields but also, sustains the soil health and productivity. Sustainability of higher yields in groundnut could be achieved through integrated plant nutrient supply (Singh *et al*. 1990) [7]. Hence, field experiments were designed to explore the possible effect of integrated input technique by using cheaply available organic wastes, biofertilizers in rationalizing nitrogen and phosphorus in the immediate and succeeding irrigated groundnut crop.

Materials and Methods
Investigations were undertaken in farmers field at Chinnakottakuppam village, Villupuram district, Tamil Nadu to find out an appropriate integrated manuring techniques for the main and succeeding irrigated groundnut crop during kharif and rain seasons. The soil was sandy clay loam with pH 7.20, low in available nitrogen (93.5), low in available phosphorus (7.35) and high in available potassium (291). The experiment was laid out in Factorial Randomised Block Design (FRBD) with three factors viz., (i) organic manures (C_1 - no organic manure, C_2 - Pressmud compost and C_3 - coirpith compost) (ii) levels of N & P (F_1 - no inorganic N & P, F_2 - 100, F_3 - 75 and F_4 - 50 per cent of recommended N and P) and iii) biofertilizers (B_1- no biofertilizers and B_2-*Bradyrhizobium* and phosphobacteria). The treatments were tested with three replications and the recommended dose of 54 kg K_2O ha^{-1} was followed for all the treatments for the first season groundnut crop (kharif). In the rabi season, the residual effect of the treatments imposed to the preceding kharif crop was assessed. The succeeding groundnut crop was raised in the same field after harvest of kharif groundnut crop without disturbing the treatmental plots with a maintainer dose of recommended level of NPK (17:34:54 kg N, P_2O_5 and K_2O ha^{-1}) was applied uniformly. The data on plant height, dry matter production, number of matured pods $plant^{-1}$ and pod yield were studied.

Results and Discussion
The data pertaining to plant height, drymatter production, number of matured pods $plant^{-1}$ and pod yield of kharif groundnut are summarized in Table 1.

Incorporation of pressmud compost (C_2) recorded significantly higher plant height of 43.86 and 47.94 cm, dry matter production of 7250 and 7317 kg ha^{-1}, matured pod number of 15.80 and 18.81 plant^{-1} and pod yield of 1911 and 1971 kg ha^{-1} during the first and second year cropping, respectively. This might be due to the favourable nutritional environment and higher uptake of nutrient and this might have increased the rate of photosynthesis, better translocation of photosynthates from source to sink which inturn favourably influenced the growth, yield contributing character subsequently resulted iln higher pod yield. Similar trend was noticed by Renugadevi and Balamurugan (2002) [6].

Application of 100 per cent recommended N and P (F_3) showed superiority in plant height and pod yield, which was 44.09 cm, 7253 kg ha^{-1}, 18.89 plant^{-1}, and 1965 kg ha^{-1} respectively during the first and second year experimentation, respectively. Nitrogen being an important constituent of protoplasm involved in the process of photosynthesis (Patra *et al.* 1975) which might have contributed towards enhancing the growth and yield of groundnut. Moreover, application of phosphorus might have ascribed to its role in the constitution of ribonucleic acid, Deoxy ribonucleic acid and ATP which regulated vital metabolic process in the plant, helping in root formation, N fixation and increase of pods plant^{-1} and pod yield. The results are in accordance with the findings of Akbari *et al*. (2003) [1].

The inoculation of biofertilizers (B_2) for supplementation of nutrients excelled in the performance of plant height (42.18 and 45.83 cm), dry matter production (6920 and 7024 kg ha^{-1}), number of matured pods plant^{-1} (14.56 and 17.35) and pod yield (1746 and 1809 kg ha^{-1}) during the first and second year experimentation, respectively. Groundnut being a leguminous crop, the magnitude of atmospheric N fixed in the plants depends on the efficiency of bacterial Strain used and growth of crop in favourable environment Tandon (1994) [8] reported that the ability to fix high amounts of N was governed by the symbiotic capability between biofertilizers and the host plant to ensure adequate supply of N for maximum growth and yield of groundnut.

The data pertaining to residual effect of treatments on plant height, drymatter production, number of matured pods plant^{-1} and pod yield of succeeding Rabi groundnut are presented in Table 2. Among the organic manures, application of pressmud compost (C_2) to the preceding groundnut crop significantly increased the growth yield attribute and pod yield of succeeding rabi groundnut crop when compared to coirpith compost (C_3) and no organic (C_1). This might be due to higher nutrient content and narrow C: N raitio of pressmud compost there was a possibility of higher mineralization of essential nutrients responsible for the favourable carry over effect of pressmud compost and growth characters, yield attributes and pod yield of the succeeding rabi groundnut. This is in concordance with the findings of Kanwar and Kapur (1987) [4].

Application of 100% N, P (F_2) and 75% (F_3) of recommended N and applied to the preceding kharif groundnut had significant residual effect on the succeeding rabi groundnut in terms of plant height, dry matter production, no. of matured pods plant^{-1} and pod yield. This might be possible when higher levels of N and P applied was likely to leave more residual nutrients in soil than a lesser quantum and resulted in more of growth, yield attribute and pod yield of succeeding rabi groundnut. Similar findings with increased growth and yield were reported by Duraisamy and Mani (2001) [3].

The plant height, dry matter production, matured pods plant^{-1} and pod yield of succeeding rabi groundnut was highest with inoculation of *Bradyrhizobium* and phosphobacteria to the preceding crop. This might be due to the cumulative effect of N fixation by *Bradyrhizobium* and solubilising effect of native and unutilized P applied to preceding groundnut. This finding is in consonance with the findings of Anuar *et al*. (1995) [2].

Table 1: Effect of organic manures, levels of N and P and biofertilizers on growth and yield of kharif groundnut

Treatments	Plant height (cm)		DMP (kg ha^{-1})		Number of matured pods plant^{-1}		Pod yield (kg ha^{-1})	
	Expt. I	Expt. II	Expt. I	Expt. II	Expt. I	Expt. II	Expt. I	Expt. II
Organic manures								
C_1- No compost	37.81	40.35	6122	6211	11.41	13.60	1358	1411
C_2- Pressmud compost @ 10t ha^{-1}	43.86	47.94	7250	7317	15.80	18.81	1911	1971
C_3 – Coirpith compost @ 12 t ha^{-1}	41.34	44.57	6762	6799	13.95	16.46	1687	1726
CD (p-0.05)	0.32	0.36	150.0	165.0	0.32	0.42	38.00	45.00
Levels of N & P								
F_1- No N & P	37.42	39.96	6062	6162	11.11	13.32	1346	1396
F_2-100% RD N & P	44.09	48.03	7253	7326	15.96	18.89	1909	1965
F_3- 75% RD N & P	42.10	45.66	6932	6972	14.48	17.16	1746	1800
F_4- 50% RD N & P	44.0	43.49	6599	6643	13.32	15.80	16.08	1650
CD (p=0.05)	0.36	0.42	173	190	0.37	0.48	44.00	52.00
Biofertilizers								
B_1 – No biofertilizers	39.83	42.74	6503	6527	12.88	15.23	1558	1596
B_2 - *Bradyrizobium* + Phosphobacteria	42.18	45.83	6920	7024	14.56	17.35	1746	1809
CD (p=0.05)	0.26	0.30	123.0	135.0	0.26	0.34	31.00	37.00

Table 2: Residual effect of organic manures, levels of N and P and biofertililzers on growth and yield of succeeding rabi groundnut

Treatments	Plant height (cm)		DMP (kg ha^{-1})		Number of matured pods plant^{-1}		Pod yield (kg ha^{-1})	
	Expt. I	Expt. II	Expt. I	Expt. II	Expt. I	Expt. II	Expt. I	Expt. II
Organic manures								
C_1- No compost	42.5	40.1	5442	6130	12.41	13.48	1613	1671
C_2- Pressmud compost @ 10t ha^{-1}	46.9	47.8	7034	7697	14.70	16.64	1958	2033
C_3 – Coirpith compost @ 12 t ha^{-1}	45.2	45.3	6440	6881	13.57	15.67	1856	1937
CD (p-0.05)	1.3	1.7	282	256	0.77	0.73	71	74
Levels of N & P								
F_1- No N & P	42.8	42.2	5914	6485	12.74	14.46	1716	1783

F_2-100% RD N & P	46.8	47.2	6759	7362	14.45	16.31	1918	1997
F_3- 75% RD N & P	46.0	44.8	6443	7035	13.90	15.47	1848	1922
F_4- 50% RD N & P	43.9	43.4	6106	6729	13.14	14.83	1753	1819
CD (p=0.05)	1.6	2.0	325	295	0.89	0.84	82	85
Biofertilizers								
B_1 - No biofertilizers	43.5	42.0	5874	6456	12.87	14.45	1716	1789
B_2 - *Bradyrizobium* + Phosphobacteria	46.2	46.8	6738	7349	14.25	16.07	1902	1971
CD (p=0.05)	1.1	1.4	230	209	0.63	0.59	58.0	60.0

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