An analysis of rice growth and its performance (cv IR 72) across India by a simulation study, utilizing the historical mean weather data agreed with the well known fact that rice could be cultivated throughtout India. The potential grain yield varied from 9.34 to 13.98 t ha-l between 9°08' and 31°25' N latitude. The potential yield is increasibng for increasing latitudes from (9° to 23° N) and elevation (0 to 900m + MSL). The growth duration varied depending upon the geographical coordinates (100 to 146days). Possibly suitable times for sowing also varies from all the 12month in the South to a short period of only 4 months in the North. Optimum time of sowing for most of the locations in India seems around 15-June. It could be concluded that a detailed more realistic prediction is posible by simulation models, provided day wise more reliable weather data including solar radiation is available for the testing centers. It also possible to compare the actual and predicted grain yields if ground truths and crop data are available.

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Effect of integrated nitrogen management on fertility status of rice soil

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Abstract : Field experiment with rice crop using N fertiliser, FYM, *Sesbania aculeata and Azospirillum* at Tamil Nadu Agricultural University farm, Coimbatore revealed that there was a depletion of all the major nutrients with the application of fertiliser N alone. Conjoint addition of green manure with fertiliser N improved the status of available N, organic carbon, NH_4-N, Olsen - P and NH_4OAc-K. A substantial increase in the fertility status was also observed with the incorporation of FYM with higher doses of N fertilisers. However, there was a drastic reduction of NO_3-N in rice soil with all the treatments studied.

(Key Words : Rice, FYM, Green manure, Azospirillum, Buildup, Depletion)

Rice crop utilises nitrogen inefficiently. Under tropical condition, the efficiency of fertiliser N was usually 30-40 per cent. The nitrogen is subjected to different losses which causes depletion of nutrients in the post harvest soil. The supply of fertiliser N along with other organic sources is known to stimulate the mineralisation and then immobilisation of organic N and reduces the losses of N (Meelu *et al.*, 1985). Integrated use of organic sources in combination with the fertiliser N and their management for efficient as well as economic use of fertiliser and maintenance of soil fertility and productivity is very essential for tropical countries. Keeping these facts in perspective, the present investigation was taken up to study the integrated nitrogen use on the fertility status of rice soil in Noyyal series (Typic Haplustalf).

Materials and Methods

A field experiment was carried out at Tamil Nadu Agricultural University Farm, Coimbatore during the year 1995 with rice IR 20 as test crop. Two factors involving five levels of N (0, 50, 100, 150 and 200 kg ha^{-1} in main plot and six different sources of organic manures (control, FYM 12.5 t ha^{-1}, *Sesbania aculeata* 12.5 t ha^{-1}, *Azospirillum* 2 kg ha^{-1}, *Azospirillum* in separate combination with FYM and *Sesbania aculeat* in subplot were tried in split plot design with four replications.

The green manure (*Sesbania aculeata.*, N-3.0%, P-0.42% and K-1.33%) and Fym (N-0.62%, P-0.23% and K-0.56%) were incorporated at 155 cm depth and allowed to decompose for 7 days. *Azospirillum* was mixed with 40 kg sand and applied before transplanting through soil application. Half of the quantity of N as urea and 60 kg P_2O_5 and 50 kg K_2O on soil test basis as per the recommendation being followed by the soil testing Laboratory, Trichirappalli were applied as basal and the remaining N was applied in two splits of equal quantities on 30 and 60 days after planting. Representative soil samples were collected from all the plots before transplanting and after the harvest of the crop. The soil samples were analysed for Alkaline $KMnO_4$-N, Organic carbon, Ammoniacal and Nitrate N, Olsen's - P and NH_4 OAc - K by using standard procedures. The Physico - Chemical properties of the experimental soil is furnished in Table 1.

Results and Discussion

The alkaline $KMnO_4$-N of the pre sowing was 262.0 kg ha-1 (Table 1). The organic carbon content of the initial soil was 0.85 per cent. The N fractions such as NH_4-N and NO_3-N content were 16.1 and 11.4 ppm respectively. The available P and K status were medium and high respectively. The available nutrient status of the post harvest soil and their changes over the pre-sowing soil test value are represented in Table 2 to 7.

Alkaline $KMnO_4$-N : Application of N through fertiliser and organic sources had a significant influence on the available Alkaline KMnO4-N status of the post harvest soil. It ranged form 180.2 to 298.4 kg ha^{-1}. It can be seen from the Table 3 that the application of fertiliser N alone showed the continuous depletion of N at all levels. This might be due to the crop removable leaching, volatalisation and immobilisation. The magnitude of the loss of the applied N as Urea through different mechanisms resulting in the depletion of N was reported by De and Diger (1955), Sarkar and Azad (1970). Among the organic sources, the green manure was found to be better in improving the N status which added N from 2.6 to 32 kg ha^{-1} with different N levels. The green manure undergoes slow decomposition and the mineralisation may help in the release of N to meet the requirement of rice crop at the critical stages (Meelu *et al.*, 1986). Incorporation of *Azospirillum* did not show any improvement in the N status of the soil.

Organic carbon : It was observed that the organic carbon content was significantly influenced by the N levels and organics. The negative balance of organic carbon was registered with the fertiliser N alone and the combination with *Azospirillum* (Table 4). The conjoint application of N with the green manure and FYM resulted in build up of organic carbon content. It was also seen that gradual build up of organic carbon content was noticed (0.01 to 0.11 per cent) with the incorporation of green manure with fertiliser N. Nearly 0.10 per cent increase in the status was observed with 200 kg N ha^{-1} in combination with green manure + *Azospirillum*. The green manure contains two fractions, one of which undergoes faster decomposition and releases N for the current crop, while the other mineralises at a slower rate. Enhanced level of organic carbon might be due to the later fractions (Bouldin, 1987).

Ammoniacal - N: The change in NH_4-N from the pre - sowing soil indicated a favorable influence in 19 treatments out of the total 30 treatments. The increase was ranging from 0.1 to 2.9 ppm. Incorporation of inorganic N alone had a considerable effect and the intensity of depletion was decreased with increase in the level of N (Table 5). The decrease in NH_4-N in post harvest soil may be due to the effect of volatalisation. The p^H of the experimental soil was 8.1 and this might have favored the volatalisation loss of N. According to Rao and Batra (1983), increase in the level of N could have increased the NH_4-N and p^H of flood water and this inturn would have led high loss of NH_3. However, the organics helped in the better build up of NH_4-N. Since the addition of *Sesbania aculeata* assists in the reduction of p^H of flood water and could have helped in the build up. This observation was in agreement with earlier reports of De Datta (1987).

Nitrate - N : From Table 6, it is very clear that both fertiliser N and organics produced a significant impact on the NO_3-N of the soil. Irrespective of N levels, the depletion of NO_3-N was conspicuous. The reason could be due to leaching loss coupled with the denitrification under submerged conditions (Koyama *et al.*, 1983). Incorporation of organics also showed the depletion of NO_3-N. but the intensity was lowered with the application of green manure as compared to the FYM and *Azospirillum*.

Available - P: A negative relationship was observed between the N levels and the build up of P (Table 7). There was an increase in depletion of available P in the plots where fertiliser N alone was applied (-1.0 to 1.8 Kg ha^{-1}). With increase in the level of N the negative balance of P was found to increase. The nitrogen would have increased in DMP of rice which inturn increased uptake of P (Lekha, 1987). Incorporation of FYM also showed in the build up of P but in a decreasing trend with N levels. However, conjoint application of fertiliser N with green manure and green manure with *Azospirillum* registered a marked improvement in the available P status. This is due to the added effect of green manure which would have solublised the Fe - P, A1-P and reductant soluble P (Ventura *et al.*, 1987 Tomas *et al.*, 1984).

Available - K : As explained in the previous context, there was a depletion of post harvest K status with increase in the N levels (Table 8) (528 to 477 ha^{-1}). The application of organic manures and their combinations improved the available K status (2.0 to 13.0 kg ha^{-1}). The highest enhancement of NH_4O Ac-K (23.0 kg ha^{-1}) was recorded with the *Sesbania aculeata* which is 4.2 per cent increase over the initial soil K, since green manure itself could have supplied appreciable quaintly of K which inturn favored in the build up of available K (Srinivasalu Reddy 1988).

From this experiment it is concluded that application of fertiliser N alone showed the depletion of primary nutrient status of the rice soil. While in combination with the organic manures, the nutrient status were improved. Among the organic manures, green manure (*Sesbania aculeata*) performed better in maintaining the soil fertility status.

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Table 1. Physico - chemical properties and available nutrient contents

Properties	Value	Available nutrients	Content
Coarse sand (%)	22.1	Alk. KMnO4-N (kg ha^{-1})	262.0
Fine sand (%)	18.0	Organic carbon (%)	0.85
Silt (%)	12.1	NH_4-N (ppm)	16.1
Clay (%)	46.0	NO3-N (ppm)	11.4
Textural class	Sandy clay loam	Olsen-P (kg ha^{-1})	15.4
pH	8.1	NH_4OAc-K (kg ha^{-1})	557
Electrical conductivity (dSm^{-1})	0.5		
Cation exchange capacity (cmol (p^+) kg^{-1})	20.8		

Table - 2. Effect of N levels and organics on content and balance of alkaline $KMnO_4$ - N in the post harvest soil (kg ha^{-1})

Organics	No organic		FYM		Green manure		Azospirillum		FYM+ Azospirillum		Green manure+ Azospirillum		Mean
N levels (kg ha^{-1})	N status	N balance	N status	N balance	N status	N balance	N status	N balance	N status	N balance	N status	N balance	
0	180.2	-81.8	238.6	-23.4	264.6	+2.6	200.4	-61.6	248.6	-13.4	269.6	+7.6	233.7
50	189.4	-72.6	254.6	-7.4	270.0	+8.0	218.6	-43.4	264.3	+2.3	274.6	+12.6	245.3
100	200.5	-61.5	272.6	+10.6	286.0	+24.0	230.6	-31.4	280.0	+18.0	290.6	+28.6	260.1
150	218.4	-43.6	282.0	+20.0	294.0	+32.0	238.6	-23.4	284.0	+22.0	298.4	+36.4	269.2
200	224.0	-38.0	282.0	+20.0	294.0	+32.0	252.0	-10.0	294.0	+32.0	298.4	+36.4	274.1
Mean	202.5		265.9		281.7		228.0		274.2		286.3		

CD (0.05) N 4.1, O 4.5, NxO 10.0

Table - 3. Organic carbon (per cent) in post harvest soil and change over the initial soil test value

Organics	No organic		FYM		Green manure		Azospirillum		FYM+ Azospirillum		Green manure+ Azospirillum		Mean
N levels (kg ha^{-1})	Content	Balance	Content	Balance	Content	Balance	Content	Balance	Content	Balance	Content	Balance	
0	0.75	-0.1	0.84	-0.01	0.86	+0.01	0.76	-0.09	0.86	+0.01	0.86	+0.01	0.82
50	0.78	-0.07	0.87	+0.02	0.89	+0.04	0.78	-0.07	0.89	+0.04	0.91	+0.06	0.85
100	0.79	-0.06	0.89	+0.04	0.92	+0.07	0.80	-0.05	0.91	+0.06	0.93	+0.08	0.87
150	0.79	-0.06	0.91	+0.06	0.94	+0.09	0.81	-0.04	0.92	+0.07	0.94	+0.09	0.88
200	0.80	-0.05	0.93	+0.08	0.96	+0.11	0.83	-0.02	0.94	+0.09	0.96	+0.11	0.99
Mean	0.78		0.89		0.91		0.79		0.90		0.92		

CD (0.05) N 0.03, O 0.03, NxO 0.07

Table - 4. NH4-N (ppm) in post harvest soil and change over the initial soil test value

Organics	No organic		FYM		Green manure		Azospirillum		FYM+ Azospirillum		Green manure+ Azospirillum		Mean
N levels (kg ha^{-1})	PHV	Change	PHV	Change	PHV	Change	PHV	Change	PHV	Change	PHV	Balance	
0	12.3	-3.8	16.0	-0.1	16.2	+0.1	13.2	-2.9	16.2	+0.1	16.6	+0.5	15.1
50	12.4	-3.7	16.5	+0.4	16.7	+0.6	13.8	-2.3	16.4	+0.3	16.7	+0.6	15.4
100	13.1	-3.0	16.8	+0.7	17.1	+1.0	14.6	-1.5	17.2	+1.1	17.5	+1.4	16.1
150	13.2	-2.9	17.8	+1.7	18.0	+1.9	14.9	-1.2	17.9	+1.8	18.2	+2.1	16.7
200	13.6	-2.5	18.4	+2.3	18.7	+2.6	15.3	-0.8	18.7	+2.6	19.0	+2.9	17.3
Mean	12.9		17.1		17.3		14.4		17.3		17.6		

CD (0.05) N 0.51 O 0.56 NxO 1.20 (PHV - Post Harvest Value)

Table - 5. NO_3-N (ppm) in post harvest soil and change over the initial soil test value

Organics	No organic		FYM		Green manure		Azospirillum		FYM+ Azospirillum		Green manure+ Azospirillum		Mean
N levels (kg ha^{-1})	PHV	Change	PHV	Change	PHV	Change	PHV	Change	PHV	Change	PHV	Balance	
0	7.2	-4.2	7.9	-3.5	8.0	-3.4	7.3	-4.1	8.0	-3.4	8.4	-3.0	7.8
50	7.3	-4.1	8.4	-3.0	8.4	-3.0	7.8	-3.6	8.0	-2.6	9.0	-2.4	8.3
100	7.5	-3.9	9.3	-2.1	9.5	-1.9	7.8	-3.6	9.3	-2.1	9.5	-1.9	8.8
150	7.7	-3.7	9.8	-1.6	10.0	-1.4	8.3	-3.1	10.2	-1.2	10.3	-1.1	9.4
200	7.9	-3.5	10.3	-1.1	10.4	-1.0	8.8	-2.6	10.4	-1.0	10.5	-0.9	9.6
Mean	7.5		9.1		9.3		8.0		9.3		9.5		

CD (0.05) N 0.26 O 0.28 NxO 0.64 (PHV - Post Harvest Value)

Table - 6. Olsen - P (kg ha^{-1}) in post harvest soil and changes over the initial soil test value

Organics	No organic		FYM		Green manure		Azospirillum		FYM+ Azospirillum		Green manure+ Azospirillum		Mean
N levels (kg ha^{-1})	PHV	Change	PHV	Change	PHV	Change	PHV	Change	PHV	Change	PHV	Balance	
0	14.4	-1.0	16.9	+1.5	17.9	+2.5	14.4	-1.0	16.7	+1.3	17.5	+2.1	16.3
50	14.4	-1.0	16.4	+1.0	17.1	+1.7	14.2	-1.2	16.1	+0.7	17.1	+1.7	15.9
100	14.1	-1.3	15.9	+0.5	16.8	+1.4	13.7	-1.7	15.8	+0.4	16.7	+1.3	15.5
150	13.8	-1.6	15.9	+0.5	16.6	+1.2	13.5	-1.9	15.6	+0.2	16.3	+0.9	15.3
200	13.6	-1.8	15.2	-0.2	16.1	+0.7	13.3	-2.1	15.1	-0.3	16.1	+0.7	15.0
Mean	14.1		16.1		16.9		14.0		15.9		16.7		

CD (0.05) N 0.52 O 0.61 NxO 1.2 (PHV - Post Harvest Value)

Table - 7. NH4 OAc - K (kg ha^{-1}) in post harvest soil and changes over the initial soil test value

Organics	No organic		FYM		Green manure		Azospirillum		FYM+ Azospirillum		Green manure+ Azospirillum		Mean
N levels (kg ha^{-1})	PHV	Change	PHV	Change	PHV	Change	PHV	Change	PHV	Change	PHV	Balance	
0	528	-29.0	576	+19.0	580	+23.0	518	-39.0	570	+13.0	578	+21.0	558
50	512	-45.0	568	+11.0	576	+19.0	503	-54.0	563	+7.0	574	+17.0	549
100	497	-60.0	562	+5.0	570	+13.0	490	-67.0	560	+3.0	566	+9.0	540
150	486	-71.0	550	-7.0	574	+7.0	481	-76.0	547	-10.0	561	+4.0	531
200	477	-80.0	540	-17.0	560	+3.0	478	-79.0	540	-17.0	559	+2.0	527
Mean	500		559		570		494		556		567		

CD (0.05) N 6.8 O 7.4 NxO 16.7 (PHV - Post Harvest Value)

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Choice of parents for number of primary branches in bunch groundnut (*Arachis hypogaea L.* ssp. *fastigiata.* Waldron.)

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Abstract : The estimated variance due to GCA was higher than SCA indicating the predominance of additive gene action for number of primary branches. The general combining ability effects revealed that ICGS 44 and ALR 2 were the good general combiners for this trait. The specific combining ability effects revealed that none of the direct crosses were good specific combiners; whereas, five combinations of the reciprocal crosses were good specific combiners indicated the importance of maternal effects for this trait. The component analysis indicated that the dominance was in excess of additive component. Intermating of the segregants or multiple crossing are suggested for the improvement of this trait. (*Key Words : Groundnut, General combining ability, Specific combining ability, Additive gene action and Non-additive gene action*).

Groundnut (Arachis hypogaea L.) is an important oil seed crop of India. It lacks varietal breakthrough due to inherent biological limitations associated with this crop. The success of any crop improvement programme mostly depends on the knowledge of the genetic architecture of the population handled and the basic genetic mechanism involved in generating variability. Number of branches is an important component, in view of its positive correlation with the pod yield (Labana et al. 1980). Studies in this trait have been carried out only with inter-subspecific crosses. In India, where the majority of the area under this crop is covered with cultigens belonging to ssp. *fastigiata* var.*vulgaris,* such studies become very essential. The objective of the present study was set towards obtaining information on the gene action governing number of primary branches in bunch groundnut.

Materials and Methods

Six groundnut varieties, namely, ICGS 44, Girnar 1, ALR 2, JL 24, GG 2 and Co 2 were crossed in a diallel mating design that included reciprocals. The F_1 hybrids of 30 cross combinations and six parents were sown in a randomised block design with three replications in the rainy season (June - October) of 1994 at Regional Research Station, Vridhachalam. Each plot had 10 rows of 3 meter length with 30 x 15 cm spacing. Ten