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Effect of Different Planting Patterns, Nitrogen and Weed Management Practices on Nutrient Uptake, Yield and Economics of Export Oriented Groundnut

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ABSTRACT

A Field experiments were conducted during two consecutive *rabi* seasons of 2008 and 2009 on sandy clay loam soils of wetland block of S.V. Agricultural College, Tirupati campus of ANGRAU, to develop certain agro-techniques for enhancing the productivity and quality of export oriented groundnut in Southern Agro climatic Zone of Andhra Pradesh. The experiment was laid out in a split - spit plot design replicated thrice. It consisted of three planting patterns viz., 22.5 cm x 10 cm (P_1), 30.0 cm x 10 cm (P_2) and 37.5 cm x 10 cm (P_3) as main plots, four nitrogen management practices viz., 100% N through fertilliser (N_1), 100% N through poultry manure (N_2), 50% N through fertilizer + 50% N through poultry manure (N_3) and 25% N through fertilizer + 75% N through poultry manure (N_4) as sub plots and four weed management practices viz., Two hand weedings at 20 DAS and 40 DAS (W_1), Pre-emergence application of Pendimathalin @1.0 kg a.i ha^{-1} + one hand weeding at 40 DAS (W_2), Post emergence application of Quzilofop –p-ethyl @ 54 g a.i ha^{-1} at 20 DAS + Hand weeding at 40 DAS (W_3) and Pre-emergence application of Pendimathalin @ 1.0 kg a.i ha^{-1}+ post emergence application of Quzilofop –p-ethyl @54 g a.i ha^{-1} at 40 DAS (W_4) as sub-sub plots. The results revealed that bold kernelled (export oriented) groundnut cv. Bheema (TG-49) could be successfully grown in the southern agro-climatic zone of Andhra Pradesh, with a promising and viable package of agro techniques, comprising of sowing groundnut with planting pattern of 22.5 x10 cm, supply of 30 kg N ha^{-1} @ 50 per cent each through fertiliser and poultry manure along with hand weeding twice at 20 and 40 DAS, for obtaining higher yield with better quality and remunerative monetary returns, without any objectionable drain on the soil productivity status.

Key words : Export oriented groundnut, Planting pattern, Nitrogen

India is one of the largest producers of groundnut along with the USA, China and Argentina, with an area, production, and productivity of 6.41 M ha, 9.18 M T and 1432 kg ha^{-1}, respectively. Andhra Pradesh is one of the leading groundnut producing states in India, particularly during rabi, with an area, production and productivity of 2.64 lakh ha, 5.07 lakh tonnes and 1921 kg ha^{-1}, respectively. Though groundnut is the leading oilseed crop of India and Andhra Pradesh, it is slowly gaining importance for confectionery and snack food purpose in domestic and international markets in recent years. The growth rate of the international market for confectionery groundnut has been increasing at an average of 2.2% per annum since 1980s.

Persistent nutrient depletion is posing great threat to sustainable agriculture. Though enhanced yield levels can be obtained with in short periods through the use of inorganic fertilizers, the importance of organic manures is promoting soil health and better plant nutrition has started receiving much recognition in the world in recent years. The supplementary and complementary use of organic manures along with chemical fertilizers by integrating organics along with the fertilizers plays a large role to meet the nutrient requirements of the crop. This demands the need to generate more information on the response of bold seeded groundnut to the row spacing and nutrient supply to exploit the fullest possible potential in a given agro-climatic domain.

MATERIAL AND METHODS

The study was laid out in split-split plot design, replicated thrice. It consisted of three planting

patterns viz., 22.5 x 10 cm (P_1), 30.0 x 10 cm (P_2) and 37.5 x 10 cm (P_3) as main plots, four nitrogen management practices viz., 100% N through fertilliser (N_1), 100% N through poultry manure (N_2), 50% N through fertilizer + 50% N through poultry manure (N_3) and 25% N through fertilizer + 75% N through poultry manure (N_4) as sub plots and four weed management practices viz., Two hand weedings at 20 DAS and 40 DAS (W_1), Pre-emergence application of Pendimathalin @1.0 kg a.i ha^{-1} + one hand weeding at 40 DAS (W_2), Post emergence application of Quzilofop –p-ethyl @ 54 g a.i ha^{-1} at 20 DAS + Hand weeding at 40 DAS (W_3) and Pre-emergence application of Pendimathalin @ 1.0 kg a.i ha^{-1}+ post emergence application of Quzilofop –p-ethyl @54 g a.i ha^{-1} at 40 DAS (W_4) as sub-sub plots.

RESULTS AND DISCUSSION

Nitrogen uptake of groundnut estimated at harvest differed significantly due to planting patterns, nitrogen and weed management practices tried, while none of the interaction effects were statistically measurable at any of the growth stages, during both the years of study, with unaltered trend between two years. At all the growth stages of estimation, the trend of nitrogen uptake under the influence of varied planting patterns, nitrogen and weed management practices were similar (Table 1).

Nutrient uptake (N, P and K) of groundnut was recorded with the planting pattern of 22.5 x 10 cm (P_1), which was significantly higher than with the other two planting patterns tried, with significant disparity between any two of them and it was found the lowest with the planting pattern of 37.5x10 cm (P_3).

Among different nitrogen management practices studied Nutrient uptake (N, P and K) of groundnut was highest with the application of 50% N each through fertilizer and poultry manure (N_3) resulted in the highest nitrogen uptake, followed by 100% N through poultry manure (N_2), 100% N through fertilliser (N_1) and 25% N through fertilizer and 75% N through poultry manure (N_4), with significant disparity between any two of them and it was the lowest with N_4.

With regard to different weed management practices tried Nutrient uptake (N, P and K) of groundnut was highest with two hand weedings at 20 DAS and 40 DAS of groundnut (W_1) resulted in the highest uptake of nitrogen, which was significantly higher than with the other practices tried. The next best weed management practice was pre-emergence application of Pendimathalin @1.0 kg a.i ha^{-1} followed by one hand weeding at 40 DAS (W_2), post emergence application of Quizalofop –p-ethyl @54 g a.i ha^{-1} at 20 DAS followed by one hand weeding at 40 DAS (W_3) and pre-emergence application of Pendimathalin @1.0 kg a.i ha^{-1} followed by post emergence application of Quizalofop–p-ethyl @54 g a.i ha^{-1} at 40 DAS (W_4), with significant disparity between any two of them. The lowest uptake of nitrogen was associated with W_4.

Under a given nutrient status, the uptake of major nutrients usually follow the trend of dry matter accrual of different treatments, barring in rarely exceptional cases of dilution effect, with which very high quantities of dry matter produced result in lesser nutrient uptake than lesser dry matter production. Of course, such rare exception did not figure in the present study and the uptake of Nitrogen, Phosphorus and Potassium followed the trend of dry matter production under varied planting patterns. Regarding the post harvest soil available status of N, P_2O_5 and K_2O the trend was exactly reverse to that of Nitrogen, Phosphorus and Potassium uptake, because the left over nutrient status in the soil immediately after the termination of a successful crop would be inversely related to nutrient uptake by the crop. Same phenomenon occurred in the case of present study, without any deviation.

Pod and haulm yield of groundnut were the highest with the planting pattern of 22.5 x 10 cm (P_1), which were comparable with 30x10 cm (P_2) and they were the lowest with 37.5x10 cm (P_3). Higher yield with closer planting pattern was the cumulative effect of more number of plants per unit area even with lesser number of filled pods per each plant. However, as mentioned P_2 might be the optimum planting pattern for the production of sound pods contributing for comparable pod yield with closest planting in the study. The lowest yield was recorded with widest planting, though pod production per plant was higher, because total number of plants per unit area was far lesser than with closer planting. Optimum planting pattern is

Table 1. Nutrient uptake (Kg ha^{-1}) of Export oriented groundnut as influenced by different planting pattern, Nitrogen and weed management practices.

Treatments	Nitrogen		Phosphorus		Potassium	
	Rabi, 2008	Rabi, 2009	Rabi,2008	Rabi, 2009	Rabi,2008	Rabi,2009
Planting pattern						
P1:22.5 cm x 10.0 cm	180.39	188.47	29.96	28.77	173.97	167.05
P2:30.0 cm x 10.0 cm	173.63	181.04	28.84	27.71	167.45	160.87
P3:37.5 cm x 10.0 cm	139.41	145.63	23.15	22.24	134.42	129.16
CD (P=0.05) P	4.51	2.37	0.61	0.42	7.16	4.05
Nitrogen Management						
N1: 100%N through fertilizer (F)	163.89	171.22	27.22	26.15	158.05	151.82
N2: 100%N through poultry Manure (PM)	171.70	179.46	28.53	27.40	165.66	159.07
N3: 50%N through F + 50%N PM	173.41	181.11	28.79	27.64	167.18	160.49
N4: 25%N through F + 75%N PM	148.92	155.54	24.73	23.78	143.58	138.06
CD (P=0.05 N	4.37	3.70	0.61	0.63	3.24	3.76
Weed management						
W1: two hand weeding at 20 &40 DAS	175.24	182.10	28.95	27.80	168.01	161.44
W2: Pendimethalin @ 0.1 kg a.i + HW at 40 DAS	167.85	176.25	28.02	26.90	162.70	156.22
W3: Quizilofop – P-ethyl @ 54 g a.i ha $^{-1}$+ HW at 40 DAS	164.24	170.90	27.17	26.10	157.76	151.55
W4: Pendimethalin @ 0.1 kg a.i ha $^{-1}$+Quizilofop – P-ethyl @ 54 g a.i	150.60	158.07	25.13	24.15	145.91	140.23
CD (P=0.05 W	4.04	3.48	0.68	0.67	3.28	4.16

the prerequisite for proper utilization of growth resources and ultimately to exploit the potential productivity of any crop. Similar results were reported by several earlier workers in groundnut (Ramesh and Sabalem 2001, Kathirvelan and Kalaiselan, 2007). There is no interaction effect. (Table 2).

Yield, and economics were found the highest with application of 50% N each through fertilizer and poultry manure (N_3), which were comparable with 100% N through poultry manure (N_2) and in turn were in parity with supply of 100% N through fertilliser (N_1), while all of them were at their lowest with application of 25% N through fertilizer and 75% N through poultry manure (N_4). Post harvest soil available nutrient status was exactly in the reverse trend to the above parameters.

In the present study, uniform dose of 30 kg N ha^{-1} (recommended dose of N for the domain of study) was supplied through different proportions of two sources, one each of organic and inorganic to four different treatments as mentioned above along with uniform dose of 40 kg P_2O_5 and 50 kg K_2O ha^{-1} through fertilisers to all the treatments. Since the organic source was poultry manure, differential quantities of P and K happened to be supplied to the four treatments tried, though N was supplied on equal nutrient basis. This has manifested variable effects on the performance of groundnut. It is an universal fact that in plant nutrition, different sources of the same nutrient often extend variable influence on the outcome of any crop. The same thing was exhibited in the present investigation, during the two years, without any altered trend. As regards the crop performance, excelled stature of growth parameters led to improved yield structure and thereby the yield and monetary returns.

The study has also left a clue of course, for further verification and fine tuning, that mineral N could be avoided by 50 per cent by substituting with

Table 2. Yield and Economics of Export oriented groundnut as influenced by different planting pattern, Nitrogen and weed management practices, average of two years.

Treatments	Pod yield (kg ha^{-1})	Haulam yield (kg ha^{-1})	Harvest Index	Net Returns (Rs. ha^{-1})	B : C Ratio
Planting pattern					
P1:22.5 cm x 10.0 cm	3690	5926	45.01	77092	5.81
P2:30.0 cm x 10.0 cm	3617	5423	41.23	74049	5.31
P3:37.5 cm x 10.0 cm	3292	4131	38.40	63660	4.31
CD (P=0.05) P	11.8	395	2.03	2891	0.17
Interaction	NS	NS	NS	NS	NS
Nitrogen Management					
N1: 100%N through fertilizer (F)	3532	5156	42.35	71890	5.07
N2: 100%N through poultry Manure (PM)	3552	5445	41.13	71716	5.19
N3: 50%N through F + 50%N PM	3552	5591	43.25	72108	5.33
N4: 25%N through F + 75%N PM	3495	4447	39.45	70686	4.99
CD (P=0.05 N	87	508	2.39	NS	0.12
Interaction	NS	NS	NS	NS	NS
Weed management					
W1: two hand weeding at 20 &40 DAS	3627	5566	43.77	74386	5.41
W2: Pendimethalin @ 0.1 kg a.i + HW at 40 DAS	3566	5284	41.08	72638	5.25
W3: Quizilofop – P-ethyl @ 54 g a.i ha^{-1} + HW at 40 DAS	3551	5083	41.8	71847	5.11
W4: Pendimethalin @ 0.1 kg a.i ha $^{-1}$ +Quizilofop – P-ethyl @ 54 g a.i	3388	4706	39.55	67529	4.82
CD (P=0.05 W	49	981	2.04	1226	0.07
Interaction	NS	NS	NS	NS	NS

an effective organic N source. The possibility of supply of total extent of N through organic source alone has also been hinted by the study. Productivity of groundnut with the above said two options was nothing lesser than with 100 per cent of N through mineral fertilizers. The former options would address the much talked about sustainability concept. However, for the immediate time being an integrated approach of plant nutrition satisfies both the farmer and the environment, as evident from the present investigations. Equality or betterment of integrated nutrition crops with trend of exploitive farming has been adequately documented by previous researchers (Shankaranarayana *et al.,* 2004, Ananda *et al.* 2006 and Kadalli *et al.*2006).

The present study has revealed that two hand weedings at 20 DAS and 40 DAS of groundnut resulted in the best performance of groundnut and better than with integrated practices of physical and chemical methods or combination of pre and post emergence herbicides. Though the results confirm those of Kadavkar *et al.,* (2004), and Virender Sardana *et al.* (2006), the time tested and promising practice of a couple of soil stirring weeding techniques appears to be distant reality during recent times, especially due to non-availability of labour for timely weeding due to an array of reasons. Inconclusive arguments are still going on between divided groups of scientific community that time has come for total reliance on herbicides for

effective checking of weeds in groundnut and at least one manual weeding should find place in the weed management package. Though both the schools of thought have their respective positive SWOT analysis proofs, it appears that the latter preaching seems to be promising for obvious reasons. Accordingly, the next best weed management practice to hand weeding twice could be integrated approach of pre-emergence low volume herbicide followed by manual manipulation around 20-25 DAS. Such successful recommendations have been made by Dharkar *et al*., (2000), Gowda *et al.,* (2002) and Walia *et al*., 2007). As regards the crop performance under the influence of different weed management practices, excelled stature of growth parameters led to improved yield structure and thereby the yield and monetary returns.

Conclusion

The results revealed that sowing groundnut with planting pattern of 22.5 x10 cm recorded the highest and application of 30kg N ha^{-1} @ 50 per cent each through urea and poultry manure along with hand weeding twice at 20 and 40 DAS is essential for obtaining higher yield with better quality and remunerative monetary returns.

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