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Growth And Yield of Export Oriented Groundnut as Influenced by Different Planting Pattern, Nitrogen and Weed Management Practices

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ABSTRACT

A Field experiments were conducted during two consecutive rabi seasons of 2008 and 2009 to develop certain agro- techniques for enhancing the productivity and quality of export oriented groundnut. The experiment was laid out in a 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. 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 planting pattern of 22.5 x10 cm, supply of 30kg N ha^{-1} @ 50 per cent each through fertiliser and poultry manure along with hand weeding twice at 20 and 40 DAS.

Key words : Groundnut, Growth, Planting pattern, Weed management, Yield.

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.

Hand-picked and selected (HPS) groundnut kernels have very large potential in international markets. Hence, more emphasis has to be given to improve and exploit groundnut as a food crop to make its farming more competitive and remunerative. The research work on agro techniques for enhancing productivity and quality of export oriented bold seeded groundnut in the Southern Agro climatic Zone of Andhra Pradesh is absolutely lacking. Keeping in view the above aspects the present investigations were taken up.

MATERIAL AND METHODS

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 .The study was laid out in split-split plot design, replicated thrice and the variety used was bold kernelled (export oriented) groundnut cv. Bheema (TG-49). 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.

Table 1. Growth and yield components of export oriented groundnut as influenced by different planting pattern, nitrogen and weed management practices (average of two years).

Treatments	Plant height at harvest (cm)	Drymatter production (kgha^{-1})	Total number of pods plant^{-1}	Number of filled pods plant^{-1}	100 pod weight (g)	Shelling out turn (%)	100 kernel weight (g)
Planting pattern							
P1:22.5cmx10.0 cm	19.91	9615	10.3	7.5	2114	72.59	79.7
P2:30.0cmx10.0 cm	19.67	9039	11.3	8.4	224.1	72.53	84.2
P3:37.5cmx10.0 cm	18.67	7423	13.1	9.2	223.8	71.76	82.5
CD (P=0.05) P	0.24	297	0.4	0.6	4.6	0.46	1.7
SEm ±	0.06	75.58	0.11	0.15	1.161	0.10	0.43
Interaction	NS	NS	NS	NS	NS	NS	NS
Nitrogen Management							
N1: 100%N through fertilizer (F)	19.47	8687	11.6	8.4	215.4	71.98	79.2
N2: 100%N through poultry Manure (PM)	19.57	8997	11.9	8.5	225.0	72.71	84.2
N3: 50%N through F + 50%N PM	19.82	9144	12.1	8.8	218.5	72.92	82.5
N4: 25%N through F + 75%N PM	18.80	7942	10.6	7.8	220.2	71.57	82.7
CD (P=0.05 N	0.49	469	0.7	0.4	4.4	NS	1.7
SEm ±	0.16	157.92	0.22	0.13	1.485	0.59	0.55
Interaction	NS	NS	NS	NS	NS	NS	NS
Weed management							
W1: two hand weeding at 20 &40 DAS	20.31	9192	12.1	8.8	222.7	73.07	81.6
W2: Pendimethalin @ 0.1 kg a.i + HW at 40 DAS	19.27	8850	11.7	8.5	220.0	72.54	83.9
W3: Quizilofop – P-ethyl @ 54 g a.i ha $^{-1}$+ HW at 40 DAS	19.2	8634	11.6	8.4	220.6	72.08	82.5
W3: Pendimethalin @ 0.1 kg a.i ha ^{1}+Quizilofop – P-ethyl @ 54 g a.i	18.24	8094	10.8	7.9	215.8	71.49	80.5
CD (P=0.05 W	0.9	397	0.5	0.4	4.0	0.72	1.5
SEm ±	0.32	140.75	0.17	0.14	1.431	0.18	0.53
Interaction	NS	NS	NS	NS	NS	NS	NS

RESULTS AND DISCUSSION

Influence of Planting Pattern

During the initial stages of crop (at 20 and 40 DAS), growth parameters *viz.,* plant height, and dry matter production (DMP) were not significantly influenced by varied planting patterns, while during later stages, the highest stature of plant height, and DMP were registered with the planting pattern of 22.5 cm x 10 cm, which were comparable with the planting pattern of 30x10 cm and all the growth parameters were of the lowest stature with planting pattern of 37.5x10 cm (Table 1).

In the present study, the cultivar of groundnut tested was of short plant stature by virtue of its genotypic trait and thereby during initial stages, growth of the crop was very slow, so that it could not respond to variation of pant densities as manifested by varied planting patterns, which meant that the

plants did not enter in to the status of competing for growth resources *viz.,* space, nutrients and light among plants in the community. However, as the crop growth tended to advance, competition for the resources seem to be initiated and progressed to display the variation of growth parameters to the extent of statistical measurability. Especially competition for radiant energy might have enhanced the internodal length and thereby increased the plant height with closer planting patterns with higher plant density compared to wider planting pattern with lower plant density. More number of leaves per unit area would be naturally the result of more number of pants per unit area, manifesting in lager total leaf area and thereby higher value of LAI compared to lower plant density under wider spacing. Higher dry matter production was the result of taller plants and more number of leaves per unit area with closer planting pattern than with wider planting with lesser plant density. The findings of the present study corroborate with those of Golding and Hartzook (1986) and Gardner and Auma (1989), who reported taller plants, higher LAI and DMP of groundnut with closer planting than with wider planting.

Yield attributes viz., total number of pods and filled pods plant^{-1} were the highest with the planting pattern of 37.5 cm x10 cm, while they were at their lowest with 22.5 cm x 10 cm and while hundred pod weight, shelling out turn and hundred kernel weight were the highest with the planting pattern of 30x10 cm, which were comparable with 37.5x10 cm and all of them were at their lowest with 22.5 cm x 10 cm (Table2).

Higher number of total and filled pods plant^{-1} was produced with wider planting with lower plant density than with closer planting with higher density. This might be due to more spatial availability for each of the plants in the community. Hundred pod weight, shelling out turn and hundred kernel weight were the highest with the planting pattern of 30x10 cm, indicating the fact that this planting pattern is neither too close nor too wide and as such could be quite optimum to produce sound pods and kernels, utilizing the growth resources optimally and performing the physiological activity of non-constrained translocation of assimilates from the source to sink. Several earlier workers demonstrated such fact and abundant documentary evidence is available to that extent (Nagaraj *et al*., 2001 and Chandrasekaran *et al.,* 2007).

Pod and haulm yield of groundnut were the highest with the planting pattern of 22.5 cm x 10 cm, which were comparable with 30x10 cm and they were the lowest with 37.5x10 cm. 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 in the immediate previous paragraph 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 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 between.

Influnce of Different Nitrogen Management Practices

Growth parameters during later stages of crop growth, yield attributes, yield, nutrient uptake and economics were found the highest with application of 50% N each through fertilizer and poultry manure, which were comparable with 100% N through poultry manure and in turn were in parity with supply of 100% N through fertilliser, while all of them were at their lowest with application of 25% N through fertilizer and 75% N through poultry manure. 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 yeas, without any altered trend.

Supply of 50% N each through fertilizer and poultry manure, 100% N through poultry manure or 100% N through fertiliser extended similar nutritional

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.	B : C Ratio
Planting pattern					
P1:22.5cmx10.0 cm	3690	5926	45.01	77092	5.81
P2:30.0cmx10.0 cm	3617	5423	41.23	74049	5.31
P3:37.5cmx10.0 cm	3292	4131	38.40	63660	4.31
CD (P=0.05) P	11.8	395	2.03	2891	0.17
SEm ±	30.0	100	0.43	736	0.04
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
SEm ±	29.2	170.99	0.88	716.41	0.04
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
W3: 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
SEm ±	17.4	138.64	0.62	435.12	0.03
Interaction	NS	NS	NS	NS	NS

effect on the performance of bold kernelled groundnut, but supply of 25% N through fertilizer and 75% N through poultry manure exerted significantly inferior effect. Groundnut being a leguminous crop and capable of symbiotic N fixation after 20 DAS, normally seldom displays sizeable variation to applied N, disregard of the source, particularly beyond three weeks after sowing. In the present case, the variation could be attributed to nutrition of variable quantities of P and K as well as unmeasured contents of some of the secondary and micronutrients supplied through poultry manure. 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 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 (Ananda, 2006 and Kadalli *et al*., 2006).

Influnce of Different Weed Management Practices

Growth parameters during later stages of crop growth; all the pooled mean yield attributes, pooled mean pod and haulm yield, harvest index and nutrient uptake (N, P and K) through out the crop growth; pooled mean gross returns, net returns and benefit-cost ratio as well as post harvest soil available status of N, P_2O_5 and K_2O were found the highest with two hand weedings at 20 DAS and 40 DAS of groundnut, which were significantly higher than with the other weed management practices tried. The next best practice was pre-emergence application of pendimathalin @1.0 kg a.i ha^{-1} followed by one hand weeding at 40 DAS, which was in parity with post emergence application of quzilofop –p-ethyl @54 g a.i ha^{-1} at 20 DAS followed by one hand weeding at 40 DAS and all the above mentioned crop parameters were found at their lowest with pre-emergence application of pendimathalin @1.0 kg a.i ha^{-1} followed by post emergence application of quzilofop –p-ethyl @54 g a.i ha^{-1} at 40 DAS**.**

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 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 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 bold kernelled (export oriented) groundnut cv. Bheema (TG-49) could be successfully grown in the southern agro-climatic zone of Andhra Pradesh with planting pattern of 22.5 x10 cm, supply of 30kg N ha^{-1} @ 50 per cent each through fertiliser and poultry manure along with hand weeding twice at 20 and 40 DAS.

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