The Andhra Agric. J 61(4):748-753, 2014

Influence of Seed Rate on Productivity and Economics of Promising Groundnut Varieties (*Arachis hypogaea* L.)

B Soumya, and K B Suneetha Devi
Department of Agronomy, College of Agriculture, Rajendranagar, ANGRAU,
Hyderabad –500 030.

ABSTRACT

A field experiment was conducted on sandy loam soils during *kharif* 2010 at College farm, College of Agriculture, Rajendranagar, Acharya N.G. Ranga Agricultural University to evaluate the effect of varieties and seed rates on yield and economics of groundnut. The treatments consisted of four groundnut varieties (Narayani, ICGV 91114, K 6 and JCG 88) and four seed rates (75, 100, 125 and 150 kg ha^{-1}) laid out inRandomized Block Design with factorial concept three replications. Among the varieties, maximum pod yield of 1835 kg ha^{-1} was obtained with Narayani followed by K 6 (1651 kg ha^{-1}) variety. With each increase in seed rate from 75 to 150 kg ha^{-1} there was corresponding increase in pod yield. Significantly higher pod yield was obtained with a seed rate of 150 kg ha^{-1}. Interaction effect between varieties and seed rates revealed that significantly higher pod yield (2150 kg ha^{-1}) was recorded with Narayani at 150 kg ha^{-1} and followed by 125 kg ha^{-1} and K 6 at 150 kg ha^{-1} which were at par. However, JCG 88 recorded higher yields with a seed rate of 125 kg ha^{-1}. The oil content was significantly influenced by varieties and JCG 88 recorded higher oil content which was at par with K 6 and Narayani varieties. Maximum gross returns (Rs.38535 ha^{-1}), net returns (Rs.25632 ha^{-1}) and benefit-cost ratio (1.98) were obtained with Narayani closely followed by K 6. Seed rate also significantly influenced the economics of groundnut. Gross returns, net returns and benefit-cost ratio increased with each increase in seed rate from 75 to 150 kg ha^{-1}. However, at the seed rate of 125 and 150 kg ha^{-1} there were no significant difference in gross, net returns and benefit-cost ratio. Thus for attaining economic pod yield, Narayani with a seed rate of 125 kg ha^{-1} and K 6 with a seed rate of 150 kg ha^{-1} would be advisable for cultivation under rainfed conditions of Southern Telangana zone, Andhra Pradesh.

Key words : Economics, Oil percent, Seed rate, Varieties.

Oilseed crops have been the backbone of agricultural economy of India. Oilseeds account for one-ninth of the total agricultural production in India and rank next to food grains. Groundnut is the most important crop among the oilseed crops grown in Andhra Pradesh. It is important not only from the point of view of its contribution to the national agricultural production, but also because of its industrial use. Thus, increasing the production and marketable surplus of groundnut is of vital importance to the national economy.

The low productivity of groundnut is mainly attributed to below optimum plant density. Sowing at optimum seed rate results in optimal plant density, reduced seed costs, lodging and also ameliorate disease problems (Hosseini *et al*., 2001). In groundnut, seed itself constitutes about 35-50 % of total cost of cultivation and considered as costly input. Seed rate of groundnut is the single main factor that influence the plant population and it in turn depends on 100-seed weight. The optimum plant density and planting pattern at one site may not be applicable to other locations because of regional variations in weather and soil conditions (Azam-Ali *et al*., 1993). Hence, the present study was taken to study the suitability of promising groundnut varieties under different seed rates in Southern Telangana zone of Andhra Pradesh.

MATERIAL AND METHODS

A field experiment was conducted at College Farm, College of Agriculture, Acharya N.G. Ranga Agricultural University, Rajendranagar, Hyderabad during *kharif*, 2010. The soil of the experimental field was sandy loam in texture, low in available N (223 kg ha^{-1}) and medium in phosphorus (28.6 kg P_2O_5 ha^{-1}) and potassium (252.9 kg K_2O ha^{-1}).

The treatments comprising of four varieties *viz.,* K 6, Narayani, ICGV 91114 and JCG 88 with

four levels of seed rates *viz.,* 75, 100, 125 and 150 kg ha^{-1} laid out in factorial RBD design with three replications. The plot size was 5.0 m × 4.2 m. The crop was sown on 17 th July at an inter row spacing of 30 cm. Spacing within the row was adjusted according to the seed rate used. i.e. 7.5, 10, 12.5 and 15 cm for seed rates of 150, 125, 100 and 75 kg ha^{-1}. A uniform dose of fertilizer supplying 20:60:30 kg N, P_2O_5 and K_2O ha^{-1} was applied as basal along the row in the form of urea, single super phosphate and murate of potash and gypsum was applied at 30 DAS @ 500 kg ha^{-1}. Two hand weedings were done as per the crop requirement. No supplemental irrigation was given as the rainfall received during the crop growth period was 733.2 mm with 44 rainy days indicating well distributed rainfall during crop growing season. The pod and kernel yield was expressed as kg ha^{-1}.

Oil content in groundnut was estimated in Nuclear Magnetic Resonance spectroscopy (NMR) technique by saturation of seed samples followed by soxhlet analysis and calibration (Jambunathan, 1985). The cost of cultivation was calculated for the individual treatment on the basis of inputs used and prevailing market price of the produce and gross monetary returns (Rs ha^{-1}) were estimated by multiplying economic yield with prevailing market price of groundnut pods. Net monetary returns (in Rs ha^{-1}) were calculated by deducting cost of cultivation from gross monetary returns for each treatment. Benefit - Cost (B: C) ratio was calculated by dividing net returns with cost of cultivation. The data recorded were subjected to analysis statistically using analysis of variance techniques (ANOVA) for factorial randomized block design as prescribed by Panse and Sukhatme (1985). Standard error of mean and the critical difference were computed at 5% level of probability.

RESULTS AND DISCUSSION

Effect of varieties:

Among the varieties, maximum pod (1835 kg ha^{-1}) and kernel yield (1338 kg ha^{-1}) was obtained with Narayani and was followed by K 6 which were significantly superior to ICGV 91114. As Narayani is genetically efficient over other varieties, this might have helped it to achieve more yield components and thereby yield. Narayani and K 6 varieties completed vegetative growth earlier and diverted their energy towards production of pegs and development of pods thus they were able to take full advantage of favorable environment. Lower yield noticed in K 6 compared to Narayani was that pod filling was affected by heavy rains that resulted in more number of pops. Sahadeva Reddy et al. (2009) reported similar higher yields with Narayani. Lowest pod, kernel yield and oil content was obtained with ICGV 91114. Shelling percentage recorded with Narayani (72.88) was significantly more compared to other varieties. Next to Narayani, K 6, ICGV 91114 and JCG 88 followed and were on par. Higher shelling percentage recorded by Narayani might be due to its varietal character with thin shell development and bunch type varieties have higher shelling out turn over runner types.

The oil content was significantly influenced by varieties. Among the varieties tested, JCG 88 recorded higher oil content followed by K 6 and Narayani which were superior to the oil content obtained with ICGV 91114 variety. However, significantly higher oil yield was recorded by Narayani (654 kg ha^{-1}) followed by K 6 variety. Lower oil yield of 362 kg ha^{-1} was recorded with ICGV 91114 variety. As oil yield is the result of oil content and kernel yield it also followed the same trend as that of kernel yield. Maximum gross returns (Rs. 38535 ha^{-1}), net returns (Rs.25632 ha^{-1}) and benefit-cost ratio (1.98) were obtained with Narayani variety and closely followed by K 6 which was superior to JCG 88 and ICGV 91114.

Effect of seed rate:

With every increment in seed rate from 75 to 150 kg ha^{-1}, the pod and kernel yield of all groundnut varieties increased. Significantly higher pod (1733 kg ha^{-1}) and kernel yield was obtained with a seed rate of 150 kg ha^{-1} and was at par with 125 kg ha^{-1}. Lowest pod yield was obtained with lower seed rate of 75 kg ha^{-1}. This may be attributed to the fact that optimum plant population had significant effect on yield of groundnut. These results are in line with those of Naeem Ahmed *et al.* (2007) and Nagaraj *et al.* (2001).

The effect of seed rates and interaction between varieties and seed rates on oil content was non significant and this indicates that oil content is more genetically controlled and is less influenced by seed rate. This is in conformity with the findings of Kaushik and Chaubey (2000) and Ragahavaiah

Table 1. Productivity of groundnut as influenced by varieties and seed rates.

Treatment	Pod yield (kg ha^{-1})	Shelling %	Kernel yield (kg ha^{-1})	Oil content (%)	Oil yield (kg ha^{-1})
Varieties					
V_1: Narayani	1835	72.88	1338	48.85	654
V_2: ICGV 91114	1125	72.35	814	44.42	362
V_3: K 6	1651	72.60	1200	49.20	590
V_4: JCG 88	1365	72.33	960	49.99	481
S.Em ±	23.5	0.07	16.9	0.76	12.3
CD (P=0.05)	67.9	0.21	48.8	2.20	35.5
Seed Rates (kg ha^{-1} kernel)					
S_1: 75	1224	72.10	878	48.11	424
S_2: 100	1352	72.40	974	48.12	471
S_3: 125	1666	72.93	1207	48.13	585
S_4: 150	1733	72.73	1254	48.12	606
S.Em ±	23.5	0.07	16.9	0.76	12.3
CD (P=0.05)	67.9	0.21	48.8	NS	35.5

Table 2. Economics of groundnut as influenced by varieties and seed rates.

Treatment	Gross returns (Rs ha^{-1})	Net returns (Rs ha^{-1})	B: C ratio
Varieties			
V_1: Narayani	38535	25632	1.98
V_2: ICGV 91114	23625	10722	0.83
V_3: K 6	34671	21768	1.68
V_4: JCG 88	28655	15752	1.21
S.Em ±	494	494	0.04
CD (P=0.05)	1426	1426	0.11
Seed Rates (kg ha^{-1} kernel)			
S_1: 75	25709	13469	1.1
S_2: 100	28403	15637	1.23
S_3: 125	34981	21891	1.67
S_4: 150	36393	22878	1.69
S.Em ±	494	494	0.04
CD (P=0.05)	1426	1426	0.11

Table 3. Interaction between varieties and seed rates on productivity (kg ha^{-1}) of groundnut.

Treatments	Seed rates (kg ha^{-1} kernel)											
	Pod yield				Kernel yield				Oil yield			
Varieties	S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_4
V_1	1440	1710	2040	2150	1041	1245	1495	1572	508	608	730	768
V_2	966	1030	1200	1304	695	744	872	945	310	330	388	420
V_3	1386	1430	1820	1968	1000	1034	1330	1435	492	510	655	706
V_4	1105	1240	1603	1510	796	896	1164	1093	398	448	582	546
S.Em ±			30.0				22.2				10.62	
CD(P=0.05)			86.6				64.0				30.67	

Table 4. Interaction between varieties and seed rates on economics of groundnut.

Treatments	Seed rates (kg ha^{-1} kernel)											
	Gross returns (Rs ha^{-1})				Net returns (Rs ha^{-1})				B: C ratio			
Varieties	S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_4
V_1	30240	35910	42840	45150	18000	23145	29750	31635	1.47	1.81	2.27	2.34
V_2	20286	21630	25200	27384	8046	8865	12110	13869	0.66	0.7	0.93	1.03
V_3	29106	30030	38220	41328	16866	17265	25130	27813	1.38	1.35	1.92	2.06
V_4	23205	26040	33663	31710	10965	13275	20573	18195	0.90	1.04	1.57	1.35
S.Em ±			987.2				987.2				0.08	
CD(P=0.05)			2851.1				2851.1				0.22	

et al. (1995). Increase in seed rate from 75 to 150 kg ha^{-1} had significantly increased the oil yield. Maximum oil yield was recorded with seed rate of 150 kg ha^{-1} and was at par with 125 kg ha^{-1}. These were in conformity with the findings of Ramesh and Samba Siva Reddy (2007).

Differential seed rate/plant density also significantly influenced the economics of groundnut. Gross returns, net returns and benefit-cost ratio increased with increase in seed rate from 75 to 150 kg ha^{-1}, however at the seed rate of 125 and 150 kg ha^{-1} there was no significant difference in benefit-cost ratio.

Interaction between varieties and seed rates

Interaction between varieties and seed rates revealed that significantly higher pod yield (2150 kg ha^{-1}) kernel yield (1572 kg ha^{-1}) and oil yield (768 kg ha^{-1}) were recorded with Narayani @ 150 kg ha^{-1} and followed by same variety @ 125 kg ha^{-1} and K 6 @ 150 kg ha^{-1} which were at par. Seed size of groundnut had significant influence on seed rate. As 100-kernel weight of K6 is maximum (38.20) than that of Narayani (37.25 g), optimum plant population and yield was obtained @ 150 kg ha^{-1} in K 6 variety. However in case of JCG 88 variety, higher pod, kernel and oil yields were obtained with a seed rate of 125 kg ha^{-1}. Due to spreading nature of crop seed rate of 125 kg ha^{-1} was found optimum as it might have avoided inter and intra species competition by providing optimum population which resulted in adequate interception of sunlight by the crop canopy at lower levels of illumination consequently resulting in higher rate of photosynthesis and yield. Significantly lower yields were obtained with ICGV 91114 @ 75 kg ha^{-1}. This trend in pod yields indicated the influence of two dominant factors viz. plant varietal characters and seed rates. Higher level of seed rate resulted in higher interception of sunlight along with maximum utilization of nutrients that produced higher assimilates which were expressed in pod and kernel yield of groundnut.

Interaction between varieties and seed rates revealed that significantly higher gross returns (Rs. 45150 ha^{-1}) were obtained with Narayani at 150 kg ha^{-1} seed rate and followed by same variety at a seed rate of 125 kg ha^{-1} and K 6 at a seed rate of 150 kg ha^{-1} which were at par. However in case of JCG 88 variety, higher gross returns were obtained with a seed rate of 125 kg ha^{-1}. Maximum net returns were obtained with Narayani variety at a seed rate of 150 kg ha^{-1} and then by same variety at the seed rate of 125 kg ha^{-1}. Next higher returns were noticed with K 6 variety at a seed rate of 150 kg ha^{-1}. However in case of JCG 88 variety, maximum net returns obtained with the seed rate of 125 kg ha^{-1} followed by seed rate of 150 kg ha^{-1}. Lower net returns were obtained by ICGV 91114 variety at a lower seed rate of 75 kg ha^{-1} which was at par with same variety at 100 kg ha^{-1}.

Higher B: C ratio was noticed with Narayani at seed rate of 150 kg ha^{-1} which was at par with the seed rate of 125 kg ha^{-1} of same variety. This may be the result of higher production of pod yield with lower seed cost under 125 kg ha^{-1} seed rate and indicated better cost effectiveness at 125 kg ha^{-1} seed rate. This was in agreement with the findings of Nagaraj *et al*. (2001). B: C ratio of K 6 variety at a seed rate of 150, 125 kg ha^{-1} and Narayani at 100 kg ha^{-1} were at par with each other. However the B: C ratio of K 6 with 150 kg ha^{-1} was superior to Narayani at 100 kg ha^{-1}. In case of variety JCG 88, higher B: C ratio was obtained with 125 kg ha^{-1} followed by 150 kg ha^{-1} seed rate.

Conclusion:

From the results of the trial it can be suggested that Narayani variety with seed rate of 125 kg ha^{-1} and K 6 variety with seed rate of 150 kg ha^{-1} can be recommended for attaining optimum plant population and maximizing pod and kernel yield of groundnut in rainfed conditions of South Telangana zone of Andhra Pradesh.

LITERATURE CITED

Azam-Ali S N Rao R C N Craigon J Wadia K D R and Williams J H 1993 A method for calculating the population/yield relation of groundnut (*Arachis hypogaea* L.) in semi-arid climates. *Journal of Agricultural Science Technology,* 121: 213-222.

Hosseini N M Ellis R H and Yazdi-Samadi B 2001 Effects of plant population density on yield and yield components of eight isolines of cv. Clark (*Glicine max* L.). *Journal of Agricultural Science Technology,* 3: 131-139.

Jambunathan R Raju S M and Barde S P 1985 Analysis of oil content of groundnuts by nuclear magnetic resonance spectrometry. *Journal of the Science of Food and Agriculture,* 36 (3): 162–166.

Kaushik M K and Chaubey A K 2000 Response of rainy season bunch groundnut (*Arachis hypogaea* L.) to row spacing and seed rate. *Crop Research*, 20 (3): 407-410.

Naeem Ahmad Mohammad Rahim and Ulas Khan 2007 Evaluation of different varieties, seed rates and row spacing of groundnut, planted under agro-ecological conditions of Malakand division. *Journal of Agronomy,* 6 (2): 385-387.

Nagaraj M V Lokanath H Malligawad and Biradar D P 2001 Productivity and economics of confectionary groundnut as influenced by plant density and fertilizer management. *Karnataka Journal of Agricultural Sciences*, 14 (4): 932-937.

Raghavaiah C V Padmavathi P and Prasad M V 1995 Response of groundnut genotypes to plant density and phosphorus nutrition in alfisols. *Journal of Oilseeds Research*, 12 (2): 295-298.

Ramesh G and Sambasivareddy A 2007 Production potential of *rabi* groundnut, *Arachis hypogaea L.* in relation to plant density and genotypes. *Journal of Oilseeds Research*, 24 (2): 322-323.

Sahadeva Reddy B Malliswarareddy A Padmalatha, Y and Shakunthala P 2009 Influence of seed size in different varieties of groundnut on its productivity. *Legume Research,* 32 (4): 298-300.

(Received on 11.03.2013 and revised on 20.03.2013)