

## Influence of plant density and fertilizer levels on the yield attributes, yield and economics of groundnut (*Arachis hypogaea* L.)

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### ABSTRACT

Field experiments were conducted at Coconut Research Station, Tamil Nadu Agricultural University, Aliyarnagar during *Rabi*-summer seasons of 2006-07, 2007-08 and 2008-09 to study the effect of different plant densities and fertilizer levels on the yield attributes and yield of groundnut. The treatments comprised of three different plant densities *viz.*, 100%, 75% and 125% and three fertilizer levels *viz.*, 100%, 75% and 125% NPK kg ha<sup>-1</sup>. The experiments were laid out in a factorial randomized block design replicated thrice. The results of the experiments revealed that among the different plant densities tried, 100% plant density recorded better yield attributes and pod yield of 2590, 2335 and 2340 kg ha<sup>-1</sup> with a BCR of 2.02, 1.90 and 1.88, respectively during the three years. Among the different fertilizer levels tried, 125% NPK recorded the maximum pod yield of 2658, 2410 and 2450 kg ha<sup>-1</sup> with a BCR of 2.05, 2.02 and 2.00, respectively during all the three years. Even though 125% NPK recorded better yield attributes and yield, it was comparable with 100% NPK fertilizers.

**Key words :** Groundnut, Plant density, Fertilizer management, Yield attributes, Yield

### INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is an important oil seed crop of India. India is the second largest producer of groundnut accounting for 38% of the total area (7.7 million hectares) and 31% production (6.7 million tonnes) of the world (Throat, 2004). The average productivity in India is 977 kg ha<sup>-1</sup> (Alam, 2002). Groundnut is known for its rich source of vegetable fats, protein and also for its use as cattle feed and concentrated organic manure.

Plant density is highly associated with yield potential and optimum plant density per unit area is an important non monetary input to decide the maximum groundnut productivity. Yield is a function of plant density and there is a considerable scope for increasing the yield by adjusting the plant density to an optimum level (Chaniyara *et al.*, 2001). Fertilizer management is another key factor in improving groundnut yield. With these ideas in view, experiments were carried out to find out the effect of plant densities and different fertilizer levels on the yield attributes and yield of groundnut.

### MATERIALS AND METHODS

Field experiments were carried out at Coconut Research Station, Tamil Nadu Agricultural University, Aliyarnagar, during *Rabi* 2006-07, 2007-08 and 2008-09 to find out the effect of plant densities and fertilizer levels on the yield attributes and yield of groundnut. The experiments were laid out in a factorial Randomized Block

Design replicated thrice. The treatments consisted of three different plant densities *viz.*, 100%, 75% and 125% and three fertilizer levels *viz.*, 75%, 100% and 125% NPK kg ha<sup>-1</sup>. The soil of the experimental field was sandy loam, low in available nitrogen (226 kg ha<sup>-1</sup>), and medium in available phosphorus (12.5 kg ha<sup>-1</sup>) and potassium (258 kg ha<sup>-1</sup>). The pH of the experimental field was 7.4 with a bulk density of 1.36 g cc<sup>-1</sup>. Mechanical analysis showed that the experimental field had 14.20% clay, 7.85% silt, 46.43% fine sand and 30.66% coarse sand. The plant density was maintained by following a spacing of 40 x 10 cm, 30 x 10 cm and 24 x 10 cm for 75 %, 100 % and 125 % plant density, respectively. Farm yard manure @ 12.5 t ha<sup>-1</sup> and gypsum 400 kg ha<sup>-1</sup> were applied uniformly to all the plots irrespective of the treatments. Fertilizers were given as basal in the previously opened furrows. All the other cultural operations were carried out as per the recommendations. Observations on yield attributing characters, pod and haulm yield were recorded and economics worked out.

### RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been presented under following sub heads:

#### *Yield attributes:*

The yield attributes varied significantly between plant densities and fertilizer levels. Among the plant densities,

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**Table 1 : Effect of plant density and fertilizer levels on yield parameters and yield of groundnut during 2006-07**

Treatments	No. of pods plant <sup>-1</sup>	Pod weight (g) plant <sup>-1</sup>	Shelling (%)	100 kernel weight (g)	Pod yield (kg ha <sup>-1</sup> )	Haulm yield (kg ha <sup>-1</sup> )	BCR
Plant density (P)							
75% (2.50 lakh ha <sup>-1</sup> ) (40 x 10 cm)	22.0	33.4	67.9	28.2	2098	3568	1.67
100% (3.30 lakh ha <sup>-1</sup> ) (30 x 10 cm)	24.7	35.6	68.6	35.9	2590	4455	2.02
125% (4.16 lakh ha <sup>-1</sup> ) (24 X 10 cm)	23.6	32.8	66.3	34.2	2470	4199	1.94
C.D. (P=0.05)	1.63	1.70	NS	1.90	149	225	-
Fertilizer levels (F)							
75% NPK (13:26:36) Kg ha <sup>-1</sup>	19.1	29.0	66.6	27.6	2134	3615	1.71
100% NPK (17:34:54) Kg ha <sup>-1</sup>	23.1	32.8	67.4	32.6	2366	4089	1.87
125% NPK (21:42:72) Kg ha <sup>-1</sup>	23.7	33.1	68.9	33.5	2658	4518	2.05
CD (P=0.05)	1.63	1.70	NS	1.90	149	225	-
PF S.E. ±	1.39	1.47	2.26	1.64	128	194	-
C.D. (P=0.05)	2.82	NS	NS	NS	NS	NS	-

NS=Non significant

100% plant density (3.3 lakhs plants ha<sup>-1</sup>) recorded the highest pod numbers plant<sup>-1</sup>, pod weight plant<sup>-1</sup> and 100 kernel weight in all the three years. However, interaction effect was found to be non significant. Normal plant density (100%) and 125% recommended dose of NPK fertilizers recorded the highest number of pods plant<sup>-1</sup> during all the years.

The highest pod numbers and pod weight plant<sup>-1</sup> under 100% plant density with 125% recommended dose of fertilizers was mainly due to sufficient space between plant rows and adequate macro nutrients through additional (25%) application which encouraged more vigorous growth of plants and also lesser interplant competition for space, light, nutrient and moisture. Similar findings of higher yield attributes due to optimum plant density were reported by Agasimani *et al.* (1984).

#### Shelling percentage:

Plant geometry and fertilizer levels did not alter the

shelling percentage during the three years of study.

#### Pod and haulm yield:

Among the plant densities, 100% plant density recorded significantly higher pod yield of 2590, 2335 and 2340 kgha<sup>-1</sup>, respectively during all the three years. This was due to the optimum population load of groundnut per unit area. Maintenance of optimum population might have resulted in utilization of available resources effectively resulted in higher number of pods which in turn reflected in higher pod yield. Similar results of higher pod yield of groundnut due to optimum plant population reported by Agasimani *et al.* (1984) are concomitant to the present result. These results confirmed that optimum population per unit area is required to harvest the maximum pod yield. The reduction in pod yield under 75% plant density (2.5 lakhs plants ha<sup>-1</sup>) with wider under row spacing might be due to the lesser plant population per unit area as reported by Kalra *et al.* (1984)

**Table 2 : Effect of plant density and fertilizer levels on yield parameters and yield of groundnut during 2007-08**

Treatments	No. of pods plant <sup>-1</sup>	Pod weight (g) plant <sup>-1</sup>	Shelling (%)	100 kernel weight (g)	Pod yield (kg ha <sup>-1</sup> )	Haulm yield (Kg ha <sup>-1</sup> )	BCR
Plant density (P)							
75% (2.50 lakhs ha <sup>-1</sup> ) (40 x 10 cm)	21.4	32.0	67.17	28.0	2024	3230	1.72
100% (3.33 lakhs ha <sup>-1</sup> ) (30 x 10 cm)	24.0	34.0	68.74	31.6	2335	3795	1.90
125% (4.16 lakhs ha <sup>-1</sup> ) (24 X 10 cm)	22.6	32.6	68.20	31.0	2176	3566	1.84
C.D. (P=0.05)	1.57	1.63	NS	1.86	173	281	--
Fertilizer levels (F)							
75% NPK (13:26:36) Kg ha <sup>-1</sup>	21.0	31.4	66.17	31.0	2088	3325	1.68
100% NPK (17:34:54) Kg ha <sup>-1</sup>	23.0	33.8	67.24	32.4	2260	3760	1.80
125% NPK (21:42:72) Kg ha <sup>-1</sup>	23.4	34.8	68.77	33.0	2410	4067	2.02
CD (P=0.05)	1.57	1.63	NS	1.86	173	281	-
PF SE ±	1.31	1.38	2.28	1.58	151	210	-
C.D. (P=0.05)	2.78	NS	NS	NS	NS	NS	-

N.S.-Non-significant

**Table 3 : Effect of plant density and fertilizer levels on yield parameters and yield of groundnut during 2008-09**

Treatments	No. of pods plant <sup>-1</sup>	Pod weight (g) plant <sup>-1</sup>	Shelling (%)	100 kernel weight (g)	Pod yield (kg ha <sup>-1</sup> )	Haulm yield (Kg ha <sup>-1</sup> )	BCR
Plant density (P)							
75% (2.50 lakhs ha <sup>-1</sup> ) (40 x 10 cm)	21.8	31.0	67.5	28.8	1976	3280	1.74
100% (3.33 lakhs ha <sup>-1</sup> ) (30 x 10 cm)	23.0	33.6	68.2	32.0	2340	3870	1.88
125% (4.16 lakhs ha <sup>-1</sup> ) (24 X 10 cm)	22.6	33.4	68.0	31.2	2286	3670	1.85
C.D. (P=0.05)	1.73	1.67	NS	1.75	179	290	---
Fertilizer levels (F)							
75% NPK (13:26:36) Kg ha <sup>-1</sup>	21.4	31.2	66.5	31.2	2110	3350	1.72
100% NPK (17:34:54) Kg ha <sup>-1</sup>	23.0	33.6	67.1	32.8	2284	3520	1.76
125% NPK (21:42:72) Kg ha <sup>-1</sup>	23.6	34.6	68.2	33.2	2450	3950	2.00
C.D. (P=0.05)	1.57	1.60	NS	1.83	179	290	-
PF S.E. ±	1.31	1.36	2.02	1.56	160	205	-
CD (P=0.05)	2.78	NS	NS	NS	NS	NS	-

NS=Non significant

**BCR:**

Among the plant densities, 100% plant density recorded the highest BCR of 2.02, 1.90 and 1.88, respectively during all the three years of study. Among the different NPK fertilizer levels, 125% NPK recorded the maximum BCR values (2.05, 2.02 and 2.00). The least BCR was with 75% plant density and 75% NPK fertilizers. Optimum spacing of 30 x 10 cm (100% plant density) was found to be more economical in groundnut than wider spacing as reported by Ramesh and Sabale (2001) and Chandrasekaran *et al.* (2007).

**Conclusion :**

The results of the experiments revealed that among the different plant densities, 100% plant density with 3.3 lakh plants ha<sup>-1</sup> recorded better yield parameters and pod yield with maximum BCR during *Rabi*-summer seasons of all the three years of study. Among the different fertilizer levels tried, 125% recommended dose of NPK fertilizers recorded significantly higher pod yield and BCR than the other levels.

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