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Effect of sowing date, irrigation and spacing on nodulation, dry matter and yield of summer groundnut (*Arachis hypogaea*)

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ABSTRACT

An experiment was conducted during summer season of 1993 and 1994 to study the effects of sowing date, irrigation and spacing on nodulation, dry-matter production and yield of summer groundnut *(Arachis hypogaea* L.), at Kalyani. Sowing on 15 February recorded significantly highest number of nodules/plant, dry weight of nodules and dry weight of pods/plant and pod yield than that on 15 January. Irrigation had no significant effect on nodulation. Two irrigations given at first phase of flowering and pod initiation recorded higher shoot and pod dry weight/plant than 1 irrigation. Three irrigations resulted in highest pod yield (2, 420 kg/ha) and moisture stress at pod-development stage and both at pod initiation and development stages reduced pod yield by 13.4 and 44.2 % respectively. The crop sown at 25 cm x 12 cm spacing recorded the highest nodules/plant, shoot dry weight and pod yield.

Key words : Summer groundnut, Sowing date, Irrigation, Spacing, Nodulation, Yield

The demand for vegetable oil in the country has been steadily increasing at the rate of more than 4% per annum, whereas the rate of increase in its production is found to be around 2% per annum. To meet the demand, the production of oilseeds has to be increased by 7% per annum (Barik and Mukherjee, 1995). Utmost priority is to be given for increasing the production of oilseeds. At present groundnut is becoming popular during summer season as a cash crop after the harvest of winter crops like potato and *toria* in Indo-Gangetic alluvial zone and there is ample scope of increasing productivity through improving agronomic management practices. Hence the present experiment was initiated with a view to study the response of summer groundnut to

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sowing date, irrigation and spacing.

MATERIALS AND METHODS

The field experiment was conducted during summer season of 1993 and 1994 at the University Farm, Kalyani. The soil was sandy loam having medium fertility status (0.62% organic carbon, 0.067% total N, 34.8 and 168.5 kg P_2O_5 and K_2O/ha respectively) and neutral, with pH 7.4. The experiment was laid out in split-plot design with 3 replications. The treatments comprised 3 sowing dates (15 January, 15 February and 15 March) in main plots, 3 irrigation schedules (1 irrigation at first phase of flowering, 2 irrigations at first phase of flowering and pod initiation and 3 irrigations at first phase of flowering, pod initiation and pod development) in sub-plots and 2 spacings (50 cm × 6 cm and 25 cm × 12 cm) in sub-subplots. The subplot size was 5 m × 6 m. The variety used was 'JL 24'. The N, P_2O_5 and K_2O were applied @ 20, 40 and 40 kg/ha respectively as basal through urea, single superphosphate and muriate of potash respectively. Enough soil moisture was ensured by a presowing irrigation for proper germination. The crop was irrigated at field capacity as per the treatment schedule. The crop was kept free from incidence of major insect pests and diseases. Crop sown on 15 January got matured at 134 days after sowing, crop sown on 15 February at 120 days and crop sown on 15 March at 112 days after sowing.

Destructive samples were taken at different stages after sowing. Ten groundnut plants were randomly uprooted with a soil block and the soil block was carefully washed to remove the soil from the roots. Shoots (leaves and stems), pods and nodules were dried separately in a hot-air oven at a temperature of 80–90°C till the constant weight was obtained.

RESULTS AND DISCUSSION

Nodulation

As the plants grew older the number and dry weight of nodules increased, but at later stages of growth the increase was at slower rate. Sowing on 15 January recorded lower number and weight of nodules at early stage (Table 1), probably due to the low temperature. The crop sown on 15 February recorded significantly higher number and weight of nodules. Irrigation had no significant effect on nodulation. This confirms the findings of Sabale and Khuspe (1989). Sowing at 25 cm × 12 cm spacing recorded higher nodule number and their weight than 50 cm × 6 cm spacing.

Shoot dry weight

Sowing date always had a significant effect on production of shoot in summer groundnut (Table 1). The crop sown on 15 January recorded significantly lower dry matter than that on 15 February and 15 March at all the growth stages. A reduction of about 11% in shoot dry weight at 110 DAS was recorded when sown on 15 January. This reduction in shoot dry weight might be due to quite low vegetative growth during January and February, because of low temperature which was around 26°C (max.) and 10°C (min.) while the optimum temperature for vegetative growth of groundnut is between 27°C and 30°C (Bolhuis and DeGroot, 1971). Higher

Table 1. Effect of planting date, irrigation and spacing on nodulation, shoot and pod dry weight and pod and haulm yield of summer groundnut (mean data of 1993 and 1994)

Treatment	Nodules/ plant at		Nodules dry weight/ plant (mg) at		Shoot dry-weight at 110 days (g/plant)	Pod dry weight at 110 days (g/plant)	Pod yield (kg/ha)	Haulm yield (kg/ha)
	30 days	90 days	30 days	90 days				
Planting date								
15 January	24	69	36	127	19.21	3.88	1,801	6,088
15 February	32	78	52	140	21.57	5.88	2,336	6,330
15 March	33	62	56	112	21.86	4.48	1,729	6,242
CD (P = 0.05)	2.3	5.4	2.7	6.2	0.86	0.27	50	NS
Irrigation								
I_1	30	68	48	120	19.83	3.17	1,351	5,746
I_2	28	70	47	129	21.24	5.38	2,095	6,394
I_3	28	71	49	130	21.57	5.68	2,420	6,520
CD (P = 0.05)	NS	NS	NS	NS	0.76	0.25	35	308
Spacing								
50 cm × 6 cm	29	66	45	116	20.58	4.60	1,765	6,112
25 cm × 12 cm	30	73	51	137	21.18	4.88	2,145	6,324
CD (P = 0.05)	NS	2.7	2.2	4.0	0.67	0.17	30	NS

Days, days after sowing; NS, not significant;
Details of irrigation treatments are given in the text

temperature favoured normal and late-sown crops for higher vegetative growth. Our results confirm the findings of Tsai *et al.* (1987).

Moisture stress at pod-formation and pod-development stages caused a significant reduction in shoot dry weight. The crop receiving only 1 irrigation recorded about 8% reduction in shoot dry weight at 110 DAS compared to the crop receiving 3 irrigations. This reduction in shoot dry weight might be due to reduction in cell enlargement. Shoot dry weight of groundnut at 30 DAS did not vary much due to variation in spacing. But at all other stages planting in 25 cm × 12 cm spacing recorded significant higher shoot dry weight than planting in 50 cm × 6 cm spacing. Pannu *et al.* (1989) also recorded higher dry-matter production with 22.5 cm × 10 cm spacing than 15 cm × 15 cm spacing.

Pod dry weight

Sowing on 15 February recorded significantly higher dry weight of pods/plant than earlier or late sowings (Table). Lowest dry weight of pods was always recorded with 15 January sowing, because crop growth was slow and reproductive growth started late. In case of late sowing, there was quick vegetative growth and maturity was attained earlier and hence no sufficient time was available for proper development and growth of pods. Crop raised with only 1 irrigation at flowering stage significantly recorded lower dry weight of pods/plant, the reduction being about 40% as compared to 2 irrigations. However, a third irrigation did not increase the pod dry weight significantly over 2 irrigations. Spacing 25 cm × 12 cm resulted in significantly higher dry weight of pods/plant than 50 cm × 6 cm spacing. Crowding within a row caused severe competition for nutrients, solar energy and space for pegging; mutual shading also reduced net photosynthetic area thus reducing production of pods/plant. Similar results were also reported by Nandania *et al.* (1992).

Pod and haulm yield

Sowing on 15 February resulted in significantly higher pod yield (2,336 kg/ha) than early or late sowings, conforming to the earlier findings of Ahmed (1992). Sowing on 15 January and 15 March reduced pod yield by 22.9 and 26.0% respectively. The highest pod yield was realized with 3 irrigations (Table 1). Water stress at pod-development stage and at both pod-initiation and pod-developement stages reduced pod yield by 13.4 and 44.2% respectively. Reproductive growth in groundnut occurs over a period of at least 2 months. Moisture stress has a depressing effect on flowering. The flower production reduced by effect of water stress on stem growth and reduction in number of nodes from which the flowers arise, and to a limited extent effect on flower buds themselves (Ochos and Wormer, 1959). Similar results were also reported by Singh *et al.* (1994). Three irrigations also recorded the highest haulm yield. Spacing 25 cm × 12 cm gave significantly higher pod yield than spacing 50 cm × 6 cm.

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