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1) Effects of sowing date and decapitation on green soybean.

Green soybean as fresh vegetable is gaining popularity in many of the soybean-producing countries of the world. Soybean as vegetable can be grown easily during rainy season because final product is harvested as immature green seed (Shanmugasundaram et al., 1982). Decapitating at 4-5 trifoliolate leaves has been found to increase the yield by 14 to 22% (Tin, 1982). It was aimed in the present experiment to ascertain the date of sowing during the rainy season of Assam and the stage of decapitation of green soybean.

An experiment with treatments of two dates of sowing (July 20 and August 1) and two stages of decapitation (6 leaves and 7 leaves) and without decapitation was undertaken in the Assam Agricultural University, Jorhat, India, during 1983. The ninth generation of the cross material SC 7601 (yellow-seeded 'Ankur' X black-seeded 'Himso 330') was used. It was laid out in six randomized blocks. Each plot (4m x 3m) received manure and fertilizers at the rate of 5q poultry manure, 20 kg N as urea, 60 kg P_2O_5 as single superphosphate, 40 kg K_2O as muriate of potash and 2 t lime as $CaCO_3$ per hectare. Seeds treated with *rhizobium* culture (5 g/kg seed) were sown at 60 kg/ha in lines 45 cm apart.

Sowing seeds either on July 20 or August 1 did not significantly influence the growth and yield attributing characters (Table 1). Nevertheless, the yields of green beans and grains per plant, as well as green beans/m^2 were significantly more with July 20 sowing.

The number of branches and pods per plant were significantly more when decapitated at 6 or 7 leaves stages compared to those of normal plants (Table 1). Seeds were heavier in plants decapitated at 7-leaf stage, other treatments being at par. Decapitation at 7-leaf stage significantly increased the yields of green beans and grains per plant as well as green beans/m^2 over those under the plants decapitated at 6-leaf stage and in these respects both the treatments proved superior to normal plants.

Decapitation at 7-leaf stage significantly increased the yield of green beans and green grains/plant as well as green grain/m^2 for both July 20 and August 1 sowing, compared with those of normal plants and also recorded better values over those of the treatment decapitation at 6-leaf stage (Table 2). In general, July 20 planting with decapitation at 7-leaf stage appeared to be better in regard to yields of green beans and grains.

Cooking quality of green grains was tested. Seeds were boiled in 0.05% solution of $Na(CO_3)_2$ and washed with cold water, then again boiled for 10 minutes in pressure cooker. The softness of the grains harvested 35 days, 45 days and 55 days after flowering was rated as very soft, soft and slightly hard, respectively, and these were much palatable.

Table 1. Effects of sowing dates and decapitation on growth, yield attributes and yield soybean

Treatments	Plant height (cm)	No. of branch/ plant	No. of pod/ plant	100-seed weight (g) at 75 days (green)	100-seed weight (g) at maturity (dry)	Yield (g) of Green bean/ plant (at 75 days)	Yield (g) of Green grain/ plant (at 75 days)	Yield (g) of Green bean/ m^2 (at 75 days)	Yield (g) of Grain/ m^2 at maturity	Days to maturity
Date of planting (P)										
July 20	80.84	8.33	91.56	31.58	16.77	163.45	93.43	1630.00	335.74	115
August 1	82.21	8.82	89.33	31.83	16.87	156.33	89.17	1556.67	333.73	110
SEd	1.09	0.39	1.48	0.27	0.26	2.19	1.40	16.24	3.45	-
CD(5%)	N.S.[a]	N.S.	N.S.	N.S.	N.S.	4.51	2.90	33.47	N.S.	-
Decapitation (D)										
Normal plant	80.15	7.50	83.09	31.16	16.53	147.52	84.08	1470.00	330.00	115
6-leaf stage	82.75	8.58	92.43	31.59	16.84	161.31	92.22	1610.00	336.80	117
7-leaf stage	81.68	9.65	95.77	32.37	17.10	170.84	97.59	1700.00	342.00	119
SEd	1.33	0.48	1.81	0.33	0.32	2.68	1.72	19.90	4.23	-
CD(5%)	N.S.	0.99	3.73	0.69	N.S.	5.53	3.55	40.99	N.S.	-

[a]N.S. = nonsignificant.

Table 2. Interaction effects of dates of planting and decapitation on soybean

Treatment combinations[a]	Plant height (cm)	Number of branches/ plant	Number of pods/ plant	100-seed weight (g) (green)	Yield (g) of Green beans/ plant (at 75 days)	Green grain/ plant (at 75 days)	Green grain/ m^2 (at 75 days)	Mature grain/m^2
$P_1 D_0$	77.80	7.6	80.55	30.89	143.25	81.86	1430.00	328.00
$P_1 D_1$	81.50	8.3	95.22	31.33	168.22	96.21	1680.00	334.40
$P_1 D_2$	83.20	8.1	98.92	32.52	178.88	102.21	1780.00	344.00
$P_2 D_0$	82.50	7.4	85.63	31.43	151.78	86.30	1510.00	332.00
$P_2 D_1$	84.00	8.8	89.74	31.86	154.40	88.23	1540.00	339.20
$P_2 D_2$	80.10	10.2	92.62	32.21	162.80	92.98	1620.00	340.00
SEd	1.88	--	2.56	0.47	3.79	2.44	28.14	4.23
CD(5%)	3.87	N.S.[b]	5.28	0.99	7.82	5.03	57.98	8.73

[a] P_1 = July 20 planting; P_2 = August 1 planting; D_0 = Normal plant; D_1 = Decapitated at 6-leaf stage; D_2 = Decapitated at 7-leaf stage.

[b] N.S. = nonsignificant.

Acknowledgments

The authors are grateful to Dr. N. D. Rana, plant breeder (oil seeds), Department of Plant Breeding, Himachal Pradesh Agricultural University, Palampur, Himachal Pradesh (India) for developing the variety and supplying seeds for further development and multiplication.

Facilities provided by Dr. B. C. Borthakur, Director of Research, A.A.U., Jorhat and Dr. N. N. Kakati, Head, Department of Agronomy, A.A.U., Jorhat are gratefully acknowledged. The authors are also very much thankful to Mrs. K. Sarmah, Department of Food and Nutrition, Faculty of Home Science, A.A.U., Jorhat for rating the cooking quality of the green bean.

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S. C. Sarmah
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2) Effect of varieties and date of sowing on the growth and yield of soybean.

The recognition of highly valued soybean in India is well understood by its cultivation of 6 lakhs hectares during 1980-81 (Bhatnagar, 1980-81). Though Assam is famous as a rice growing area, the typical uplands are not properly utilized for rice because of partial to nonavailability of irrigation water. These areas are either partly used for raising rice seedlings or put to summer vegetables. Thus, land availability for the cultivation of soybean appears to be bright. For its widespread cultivation, varieties suitable to different agro-climatic zones of India are continued to be identified. Nevertheless, a good variety would express its full yielding potential when optimum agronomic practices prevail and, in this regard, date of sowing is second to none of the practices.

The present experiment under All India Coordinated Research Project on Soybean, comprising the four varieties (PK-271, PK-308, DS 73-16 and Bragg) and three dates of sowing (June 5, July 5 and August 5), was undertaken in the Assam Agricultural University, Jorhat, during *Kharif* season of 1982. The experiment was laid out in the slightly acidic (pH 6.5 due to continuous liming at 1 ton /ha/year) sandy loam soil by adopting randomized block design with three replications. The plots of 6m x 3.15m were fertilized with 20 kg N, 60 kg P_2O_5 and 40 kg K_2O per hectare rates. *Rhizobium*-inoculated seeds at the rate of 70 kg/ha were sown in 6m long rows spaced out at 45 cm. After sowing, plots were mulched with straw in order to prevent the beating action of rains. At each date of sowing, a nursery adjacent to experimental field was also sown for the purpose of replacing seedlings of the main field in the event of mortality. Two weedings, at 15 and 30 days after sowing, were done; the second weeding was followed by a light earthing up. Nuvan (0.01%) was sprayed against Bihar hairy caterpillar.

Table 1. Effect of varieties and dates of sowing on yield attributes and yield of soybean

Treatments	Plant height (cm)	Number of branches/ plant	Number of pods/ plant	Length of pod (cm)	Number of seeds/ pod	100-seed weight (g)	Grain yield (g/ha)	Days to maturity
Varieties								
PK-271	77.00	4.90	190.81	4.36	2.43	13.21	27.47	110.44
PK-308	81.22	8.87	124.07	4.32	2.42	12.62	21.92	109.77
DS 73-16	98.44	4.48	178.58	4.18	2.37	11.78	24.57	107.00
Bragg	119.57	5.63	169.74	4.15	2.48	14.67	22.62	113.44
CD 5%	7.15	1.07	24.05	N.S.[a]	N.S.	0.73	3.19	3.27
Dates of sowing								
June 5	101.08	4.33	96.13	2.30	4.64	12.14	19.58	121.08
July 5	103.54	6.22	206.50	2.43	4.40	12.91	27.00	106.91
August 5	77.55	7.36	194.78	2.55	3.72	13.81	25.86	102.49
CD 5%	6.18	0.93	20.83	N.S.	0.53	0.85	2.76	2.83

[a]N.S. = nonsignificant.

The standard variety 'Bragg' registered significantly more plant height among the varieties tested (Table 1). Both 'PK-271' and 'PK-308', being at par, recorded significantly shorter plant height as compared with that of 'DS 73-16'. The variety PK-308 recorded significantly greatest number of branches per plant while the differences in such numbers between the varieties PK-271 and DS 73-16 and that between PK-271 and Bragg were nonsignificant. The difference in the number of pods/plant between the varieties PK-271 and DS 73-16 and that between DS 73-16 and Bragg were significant, but all of them proved superior to PK-308. The other yield-attributing characters like the length of pod and the number of seeds per pod did not vary due to different varieties. The variety Bragg recorded significantly higher 100-seed weight than other varieties. Though the varieties PK-271 and PK-308 were at par but recorded significantly more 100-seed weight than that of the variety DS 73-16. Therefore, the variety PK-271, with more number of pods per plant and reasonably better 100-seed weight resulted in significantly highest grain yield (27.47 q/ha) as compared with other varieties. The other varieties did not produce any significant differences in yield. The variety PK-271, with about 110 days duration, out-yielded the standard variety Bragg.

Plant heights of June 5 and July 5 plantings were about equal, but the later August 5 planting resulted in significantly shorter plants as compared with earlier dates (Table 1). The number of branches, on the other hand, significantly increased with every advancement of sowing dates.

The difference of number of pods per plant due to July 5 and August 5 sowing was nonsignificant, but both of them proved superior to June 5 sowing. The length of pod was significantly depressed due to August 5 sowing as compared with earlier dates, which were at par in this regard. The number of seeds per pod due to different dates of sowing were nonsignificant. The effects of earlier two dates of sowing on the 100-seed weight were statistically similar, but the later date of August 5 sowing registered significantly more weight as compared with former dates. Therefore, July 5 and August 5 sowing with more number of pods per plant consequently did not vary in respect to yield. The June 5 sowing registered lowest yield and also lengthened the life span of the crop significantly.

The interaction effect of varieties and date of sowing did not affect the yield significantly.

Acknowledgments

The authors are thankful to Dr. B. C. Barthakur, Director of Research, for providing facilities and Sri Bipin Baruah for carrying out statistical analysis.

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S. C. Sarmah
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3) Effect of varieties and population densities on the growth and yield of soybean.

The varieties of a crop with their differential genetical makeup exhibit wide variation in regard to both growth habits and ultimate yield. The maintenance of optimum plant population will not only provide ample scope for proper growth of a variety but will largely shape the ultimate yield, because the yield of a crop in general is a function of yield per plant and plant population per unit area. Experimental evidence is available to show that optimum plant populations per unit area for different soybean varieties are not the same (Singh et al., 1974; Narayana, 1976; Reddy and Singh, 1976; Deshmukh et al., 1977).

A field experiment, under All India Coordinated Project on Soybean, comprising six varieties and three population densities was conducted during July to October of 1982 at the Instructional cum Research Farm of the Assam Agricultural University, Jorhat. The soil of the experimental site was slightly acidic (pH 6.5) sandy loam. The experiment was laid out in a split plot design with three replications where varieties were alloted to the main plots and population densities to the sub-plots. The *Rhizobium*-treated seeds were sown in 6m-long rows laid out at 45 cm apart in the plots of 6m x 3.15m. The number of plants per plot accommodated were 378, 756 and 1134 so as to maintain plant population of 0.2 million, 0.4 million and 0.6 million per hectare, respectively. The plots were fertilized with 20 kg N, 60 kg P_2O_5 and 40 kg K_2O/ ha rates. On the day of sowing, a strip was also sown with different varieties for the purpose of gap filling in the main field when required. After sowing, straw mulch was applied to protect the seeds from the beating action of rains.

The variety 'Bragg' had significantly higher plant height as compared with all 'PK' varieties and DS 73-16 (Table 1). The plant height of DS 73-16 was significantly higher than those of PK varieties but was at par with that of PK-271 only. The varietal differences in regard to number of branches per plant, pods per plant, and number of seeds per pod were nonsignificant. But the 100-seed weight of the varieties PK-271, PK-327, and Bragg were significantly more than those of the varieties PK-262, PK-308, and DS 73-16. The variety PK-262 had, however, significantly higher 100-seed weight compared with PK 308 and DS 73-16; the latter varieties were at par in this regard. The yield differences of the varieties PK-262 and PK-271 were nonsignificant but their yield levels were significantly more than those of the other varieties tested. The yield of the variety PK-327, though, appeared to be at par with that of PK 308 but was significantly superior to Bragg and DS 73-16. However, the yield levels of PK-308, Bragg and DS 73-16 were at par.

The variable plant population significantly affected none of the characters but the number of pods per plant and yield. The number of pods per plant was significantly more with 0.2 million population as compared to higher population rates, viz., 0.4 million and 0.6 million per hectare which in turn were at par. The increase of plant population from 0.2 million to 0.4 million did not bring about any significant yield difference, but further increase to 0.6 million plant population significantly increased the yield as compared to lower populations.

The interaction effect of varieties and plant population was found to be significant on number of seeds per pod, 100-seed weight and on grain yield. Here, the interaction effect on yield is discussed (Table 2). Within 0.2 million plant population, the varieties DS 73-16, Bragg and PK-271 yielded at par; the yield levels of these varieties were significantly more than those of other

Table 1. Effect of varieties and plant population on the yield attributes and yield of soybean

	Plant height (cm)	No. of branches/ plant	No. of pods/ plant	No. of seeds/ pod	100-seed weight (g)	Grain yield (q/ha)
Varieties (V)						
DS 73-16	94.53	5.4	112.58	2.3	11.95	18.95
PK-262	65.64	4.4	76.15	2.3	13.29	27.28
PK-271	78.73	5.6	74.78	2.3	14.09	26.30
PK-308	70.62	6.0	112.35	2.4	12.02	20.45
PK-327	67.37	5.0	64.40	2.4	14.27	22.25
Bragg	149.49	5.9	98.35	2.2	14.59	19.28
CD 5%	20.35	N.S.[a]	N.S.	N.S.	0.55	2.56
Plant population (P)						
0.2 m/ha[b]	86.15	5.5	100.31	2.4	13.42	21.27
0.4 m/ha	90.83	5.5	84.23	2.3	13.48	21.78
0.6 m/ha	86.21	5.2	84.76	2.3	13.21	24.20
CD 5%	N.S.	N.S.	14.53	N.S.	N.S.	1.88

[a] N.S. = nonsignificant.

[b] m/ha = million per hectare.

Table 2. Interaction effect of varieties and plant population on the yield of soybean

Varieties (V)	Plant population (P) in million per hectare			
	0.2	0.4	0.6	Mean
DS 73-16	22.66	17.53	16.67	18.95
PK-308	16.36	18.25	26.75	20.45
Bragg	26.55	15.96	15.33	19.28
PK-271	25.73	27.46	25.71	26.30
PK-327	18.35	22.40	26.00	22.25
PK-262	18.01	29.06	34.76	27.28
Mean	21.27	21.78	24.20	

CD 5%

V at the same level of P = 4.24

P at the same level of V = 4.68

varieties tested. With 0.4 million plant population, PK-271 and PK-262 produced statistically similar yields but were significantly superior to other varieties. At 0.6 million population level, the yields of PK-262 was significantly increased over that of any other varieties. It may further be noted that the yield levels of PK-308 and PK-327 became at par with that of PK-271 under this high population level. By increasing the population from 0.2 million to 0.4 million, the yield level significantly depressed in case of the varieties DS 73-16 and Bragg. However, PK-271 maintained the uniform yield level at any given plant population. For varieties like PK-262, PK-308, and PK-327, the yields continued to increase with the increase in plant population and so highest population of 0.6 million resulted in higher yield. From these yield trends it may be inferred that there is still scope for increasing the plant population for the varieties PK-262, PK-308, and PK-327.

Acknowledgments: The authors are thankful to Dr. B. C. Barthakur, Director of Research, and Dr. N. N. Kakati, Head, Department of Agronomy, Assam Agric. University, Jorhat, for providing facilities, and Mr. B. Baruah for carrying out the statistical analysis.

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S. C. Sarmah
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4) Effect of varieties and plant population on grain yield and two yield attributes of soybean

A field experiment was conducted during rainy seasons of 1980 and 1981 to study the effect of varieties and plant population on yield of soybean at the Agronomy Farm, Assam Agricultural University, Jorhat. The seeds were sown on 30 June during both the years. The soil of the experimental plots was sandy loam with pH 5.3. Four varieties ('PK-71-21'; JS-72-375', 'JS-2' and 'Bragg') were included for study. The seeds were sown at a distance of 45 cm between rows, 3.3, 5.0 and 10.0 cm between the seeds in order to accommodate 0.6 million, 0.4 million and 0.2 million plant population, respectively. A split plot design with three replications with varieties in the main plots and plant population in the sub-plots was adopted. A basal dose of fertilizers (20 kg N/ha, 60 kg P_2O_5/ha and 40 kg K_2O/ha) was applied before sowing. Data on yield, and two yield attributes, as affected by various treatments, are presented in Table 1.

Table 1. Effect of varieties and plant population on grain yield (q/ha) and two yield attributes of soybean

Treatments	Grain yield (q/ha)		100-grain weight (g)		Number of root nodules/plant	
	1980	1981	1980	1981	1980	1981
Varieties						
PK-71-21	18.58	28.77	14.90	15.99	44.85	44.48
JS-72-375	17.51	25.39	13.45	13.46	40.60	36.70
JS-2	18.04	27.50	14.49	14.78	44.34	36.10
Bragg	20.83	31.59	15.90	15.07	50.04	41.66
CD = 0.05	2.39	3.11	2.08	1.94	4.2	4.95
Plant population						
0.2 m/ha	17.08	28.81	14.68	14.75	42.88	40.26
0.4 m/ha	19.18	26.58	14.67	14.78	43.29	39.00
0.6 m/ha	20.71	29.55	14.69	14.93	44.69	42.04
CD = 0.05	N.S.[a]	N.S.	N.S.	N.S.	N.S.	N.S.

[a]N.S. = not significant.

The differences in grain yield due to varieties were significant. The grain yield of Bragg, being at par with PK-71-21, was significantly more than those of the varieties JS-72-375 and JS-2. The yield differences of the varieties PK-71-21, JS-72-375 and JS-2 were nonsignificant. The yield of Bragg was 20.85 q/ha and 31.59 q/ha during 1980 and 1981, respectively. Grain yield of Bragg and Pk-71-21 was about 16.0 and 5.7% and 20.0% and 11.7% higher during 1980 and 1981, respectively, over JS-72-375 which produced the lowest grain yield. Differences in grain yield among the varieties may be attributed principally to the differences in test weight of 100 seeds and number of root nodules per plant. The perusal of the data in Table 1 would reveal that, among all the four varieties, Bragg and PK-71-21 registered the higher 100-seed weight and greater number of nodules per plant. These two, being the varietal characters, showed wide range of differences among varieties which were reflected in differences in grain yield. Choudhury and Wamanan (1976) and Narayana (1976) also observed a similar varietal difference in soybean in respect to grain yield.

During both years, varying levels of plant populations did not affect the yield significantly. Weight of 100 seeds and number of root nodules per plant were also not affected by the variables studied. Increasing the plant population from 0.2 to 0.6 million might have increased the intrarow plant competition to such an extent that the possible effect of increased plant population on the per-hectare yield was nullified by reducing the favorable effects on other yield parameters. Several workers (Singh et al., 1974; Reddy and Singh, 1976; Pant and Joshi, 1977) have also reported nonsignificant results by increasing the plant population from 0.2 to 0.6 million on the yield of soybean.

Acknowledgement: The authors are grateful to the Project Coordinator, Soybean Research Project, Director of Research and Head of the Department of Agronomy, Assam Agricultural University, Jorhat, for providing the facilities and necessary guidance in conducting the experiments.

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S. C. Sarmah
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5) Performance of winter soybean under varying levels of irrigation.

Possibility of growing soybean during winter season has been revealed by several workers (Sarmah, 1979; Mandloi and Tiwari, 1971). But the success of a winter crop depends mainly on available soil moisture. The average rainfall for the last ten years at the station during winter months (November to March) was 104.28 mm, which is not enough to sustain a good crop of soybean. The present investigation, therefore, was undertaken to study the influence of irrigation levels on yield performance of four soybean cultivars.

Field experiment was conducted during winter 1981-82 on medium low land rice soil of pH 5.30 having clay loam texture at the Instructional-cum-Research Farm of Assam Agricultural University, Jorhat. The treatments consisted of three levels of irrigation (I_1-pre-sowing irrigation, I_2-pre-sowing irrigation followed by one irrigation at 40 mm Cumulative Pan Evaporation (CPE), I_3-pre-sowing irrigation followed by two irrigations at 40 and 75 mm CPE) and four soybean cultivars, DS 73-16 (V_1), JS-2 (V_2), JS 72-375 (V_3), and PK-271 (V_4). The experiment was conducted in split-plot design with three replications, keeping irrigation levels in the main plot and varieties in the sub-plots. The crop received a basal application of 20 kg N, 60 kg P_2O_5 and 40 kg K_2O/ha at the time of final land preparation. Soybean seed (80 kg/ha) inoculated with proper rhizobium culture, were sown December 25, 1981, in lines 30 cm apart. The plants were thinned 21 days after emergence to maintain an intrarow spacing of 5 cm. Rainfall received during the crop season was 100.50 mm.

Table 1. Effect of levels of irrigation on yield and yield attributes of a few soybean varieties

Treatment	Number of pods/plant	100-seed weight (g)	grain yield (q/ha)
Irrigation (I)			
Pre-sowing irrigation (I_1)	11.25	11.20	5.10
Pre-sowing irrigation followed by one irrigation at 40 mm CPE (I_2)	17.83	13.28	8.59
Pre-sowing irrigation followed by two irrigation at 40 and 75 mm CPE (I_3)	27.58	14.79	11.96
CD 5%	3.74	0.77	0.39
Varieties (V)			
DS 73-16 (V_1)	30.22	13.81	12.75
JS-2 (V_2)	14.22	13.61	6.44
JS 72-375 (V_3)	15.33	12.62	7.68
PK-271 (V_4)	15.77	12.32	7.37
CD 5%	2.25	0.67	0.65

Table 2. Number of pods/plant and grain yield (q/ha) as influenced by levels of irrigation and soybean varieties

Irrigations / Varieties	Number of pods/plant				Grain yield (q/ha)			
	I_1	I_2	I_3	Mean	I_1	I_2	I_3	Mean
DS 73-16	17.67	27.67	45.33	30.22	7.40	11.90	18.96	12.75
JS-2	7.67	15.33	19.67	14.22	2.93	6.43	9.96	6.44
JS-72-375	9.00	14.00	23.00	15.33	5.47	8.40	9.13	7.68
PK 271	10.67	14.33	22.33	15.78	4.63	7.67	9.80	7.37
Mean	11.25	17.83	27.58	--	5.10	8.59	11.96	--
	CD 5%				CD 5%			
V within I	3.90				1.11			
I within V	5.00				1.03			

An appraisal of the data in Table 1 revealed that the highest grain yield of 11.96 q/ha was associated with the treatment pre-sowing irrigation followed by two irrigations at 40 and 75 mm CPE (I_3) and was followed by I_2 and I_1 in decreasing order. The increase in yield in I_3 and I_2 over I_1 was 61.0 and 43.8%, respectively. Beneficial effect of supplementary irrigation was due to significant improvement in number of pods/plant as well as 100-seed weight.

The variety DS 73-16 produced significantly higher grain yield (12.75 q/ha) than rest of the varieties. The varieties JS 72-375 and PK-271 were at par in respect to grain yield and the variety JS-2 produced the lowest yield (6.44 q/ha). Higher grain yield associated with the variety DS 73-16 was due to significantly higher number of pods/plant (30.22) and 100-seed weight (13.81 g).

Each supplementary irrigation caused the grain yield to increase significantly over the preceding one in all the varieties (Table 2). The variety DS 73-16 maintained its superiority over the others in each level of irrigation and produced the highest grain yield of 18.96 q/ha with pre-sowing irrigation followed by two irrigations at 40 and 75 mm CPE. Similar trend was observed for the number of pods/plant.

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6) Effect of dates of planting on five soybean varieties.

Assam is one of the seven states comprising the North Eastern region of India. The plains of the Brahmaputra Valley lie between 24° to 28° N Latitude, 90° to 96° East Longitude and its elevation (above M.S.L.) ranges from 35 m (Dhubri) to 106 m (Dibrugarh). Soybean was introduced in Assam in 1975 through the Soybean Research Project sponsored by the Indian Council of Agriculture Research, New Delhi. Since then, its yield potential has been found high; the average grain yield ranging from 2.5 to 3.0 t/ha with the highest reaching 4.5 t/ha. Soybean is a determinant crop. It was, therefore, felt necessary to identify the best sowing time for the varieties suitable for the area. A field trial was conducted at Assam Agricultural University Farm, Jorhat, during rainy season of 1980 (July to October) on sandy loam soil, to find out the optimum dates of sowing of the recommended varieties of soybean.

The experiment was laid out in a randomized block design with three replications. The size of the individual plot was 4 m x 3.15 m and all plots received basal application of N, P_2O_5 and K_2O @ 20 kg, 80 kg and 60 kg per hectare, respectively. The seeds were treated with *Rhizobium* culture @ 5 g/ha of seed at the time of sowing and were sown in rows 45 cm apart. The experimental plots were kept free from weeds throughout the growing season by hand weeding.

Data on grain yield, weight of 100-seeds and plant height are presented in Table 1. The grain yield of soybean was significantly influenced by different dates of sowing. The earliest date of sowing (May 16) recorded significantly the highest grain yield (22.70 g/ha) compared with the other dates of sowing. Delay in sowing beyond May 16 reduced grain yield significantly. The higher grain yield obtained due to early sowing on May 16 may be due to varietal behavior or efficient utilization of soil moisture. The reduction in grain yield in later dates of planting may be accounted for by low rainfall at the time of pod formation and all other varieties were short duration excepting 'Bragg' and UPSM-19. Higher yields of soybean due to early planting (May and early June) as compared with late planting (beyond June last) were also reported by Maley and Sharma (1973), Lokras and Tiwari (1977) and Lokras (1980).

One-hundred-seed weight and plant weight differed significantly for planting dates. Crops planted on earlier dates were vigorous in growth as would be evident from the data on plant height as compared with late planting.

Varieties showed perceptible variations in respect to growth (plant height) and 100-grain weight (Table 1) which influenced the grain yield of the varieties. Variety Bragg gave the highest grain yield (15.52 q/ha) which was at par with UPSM-19 (14.80 q/ha) and significantly outyielded the other varieties. These two varieties had heavier seed weight and plant height which may be the possible causes for higher yield. A measure of relative productive efficiency for the varieties was also worked out in terms of grain yield per day per hectare. The per day per hectare yields were more in JS-72-1 (14.67 kg) and JS-2 (14.61 kg) than the other three varieties. In an intensive multiple cropping system where both time and space are equally important, these

Table 1. Effect of dates of planting on yield attributes and yield (q/ha) of soybean varieties

Treatments	Plant height (cm)	100-grain weight (g)	Days to maturity	Grain yield (q/ha)	Grain yield (kg/day/ha)
Date of planting (D)					
May 16	76.94	14.18	111.20	22.70	20.41
June 30	88.74	15.20	108.87	19.95	18.32
July 22	74.81	14.39	104.00	10.30	9.90
August 20	51.54	13.62	97.80	2.96	3.03
SED (D. Means)	2.86	0.22	0.56	0.95	--
C.D. (0.05)	5.77	0.44	1.13	1.92	--
Varieties (V)					
Bragg	98.33	15.32	122.25	15.52	12.53
JS-2	45.55	13.55	90.00	13.15	14.61
JS-72-1	87.10	14.48	92.25	13.54	14.67
JS 72-375	51.56	13.44	96.08	12.89	13.42
UPSM-19	115.54	14.95	126.75	14.80	11.68
SED (V. Mean)	3.19	0.24	0.62	1.06	
C.D. (0.05)	6.45	0.49	1.26	2.14	

Table 2. Interaction effects of date of planting and variety on yield attributes and yield of soybean

Date of planting (D) / Variety (V)	Plant height (cm)				Days to maturity				100-seed weight (g)			
	May 16	June 30	July 22	August 20	May 16	June 30	July 22	August 20	May 16	June 30	July 22	August 20
Bragg	130.13	127.30	82.00	53.87	135.00	130.33	115.67	108.00	15.58	15.56	15.39	14.74
JS-2	55.53	42.97	51.63	32.07	91.00	90.00	90.00	89.00	13.53	13.65	13.32	13.68
JS 72-1	121.57	94.67	81.20	50.97	95.00	92.00	92.00	90.00	13.10	16.17	14.60	14.06
JS 72-375	71.73	41.03	46.93	46.53	98.00	97.00	97.33	92.00	13.50	15.54	13.64	11.07
UPSM-19	137.87	137.73	112.30	74.27	137.00	135.00	125.00	110.00	15.18	15.08	14.98	14.57
SEd (Dx V)	6.38				1.25				0.49			
C.D. (0.05)	12.91				2.52				0.97			

two varieties would be considered useful. Differential responses of dates of planting were found with the varieties in respect to plant height dates to maturity and 100-seed weight which is presented in Table 2.

Acknowledgement: The authors are grateful to the Project Coordinator, All India Coordinated Research Project on Soybean (ICAR) and the Director of Research, Assam Agricultural University, Jorhat, for providing facilities to conduct the experiment.

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