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Effect of Sowing Dates and Varieties on Growth, Yield and Yield Attributes of Soybean (*Glycine max* L.) in Odisha

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A B S T R A C T

A field experiment was conducted at research farm of All India Coordinated Research Project on Soybean, Regional Research and Technology Transfer Station (OUAT), Bhawanipatna, Odisha, India during *kharif*, 2017 under rainfed condition to assess the response of four soybean varieties *viz.*,JS 20-116, RVS 2010-1, PS 1556 and JS 97-52 as check in two sowing dates i.e. 1st week of August and 3rd week of August, 2017. The data on crop growth parameters indicated that date of sowing has significant effect on dry weight of plant m^{-2} and crop growth rate (CGR), while the effect on relative growth rate (RGR) was non significant. Higher dry weight of plant m^{-2} was recorded in August 1st week sowing (35.6, 87.8 and 161.0 g) than late sowing (23.8, 64.0 and 123.2 g) at 30, 45 and 60 days after sowing (DAS), respectively. Dry matter accumulation increased progressively with each successive growth stage of the crop in both the dates of sowing. The CGR recorded between 30 to 45 DAS and 45 to 60 DAS followed the same trend as that of plant dry weight. Sowing of soybean during 1st week of August recorded significantly the higher seed yield (1417 kg ha^{-1}) than late sowing (1200 kg ha^{-1}) in 3rd week of August. The increase in grain yield due to early sowing was ascribed to higher number of pods $plant^{-1}$ and higher seed index. Among the four test varieties of soybean, the variety JS 20-116 recorded highest seed yield in both August 1st week and 3rd week sowing with mean seed yield of 1550 kg ha^{-1} followed by RVS 2010-1 (1367 kg ha^{-1}). The seed yield in JS 20-116 and RVS 2010-1 was 47.6 and 30.2% higher than the check variety JS 97-52 (1050 kg ha^{-1}), respectively. From the results of the experiment it is evident that sowing soybean variety JS 20-116 during 1st week of August will avoid rainy days during maturity period and will give higher yield in Odisha.

Introduction

Soybean is one of the important oil and protein rich crops of the world. It is the cheapest source of vegetable oil and protein. It contains about 40 per cent protein well balanced in essential amino acids, 20 per cent oil rich in poly unsaturated fatty acids specially Omega 6 and Omega 3 fatty acids, 6-7 per cent total mineral and 5-6 per cent crude fibre (Chauhan *et al*., 1988). Soybean is known for its wide adaptability coupled with higher productivity per unit area compared to other grain legumes. It can tolerate drought as

well as sustain uniform moisture conditions. Under rainfed conditions, soybean gives higher yield when sown with the onset of monsoon (Jansani *et al.*, 1993). However, during the recent years the erratic pattern of monsoon rain is causing failure of early sown *kharif* crops. Generally, the time of planting varies depends on the climatic condition of the region and the variety to be grown. The average annual rainfall in Odisha is 1451.2 mm. The monsoon rain continues from 2nd week of June to end of September, sometimes it continues upto 2nd week of October. As soybean is a short duration crop, the crop sown with onset of monsoon faces rainy days during maturity stage which leads to deterioration of seed quality and pose harvesting problem. Planting date is an important factor affecting soybean growth, development and yield. The present investigation was carried out with a view to find out optimum sowing time and suitable variety of soybean for *kharif* season to get better yield under rainfed condition without being affected by rain during harvesting period.

Materials and Methods

The experiment was conducted at research farm of All India Coordinated Research project on Soybean, Regional Research and Technology Transfer Station (OUAT), Bhawanipatna, Odisha, India during *kharif*, 2017 under rainfed condition to assess the response of soybean varieties to different sowing dates. Bhawanipatna is situated at 19°54' N latitude and 83°10' E longitude. The soil of the experimental field was clay loam and slightly acidic in reaction (pH 6.2), having organic carbon 0.56% and available N, P_2O_5 and K_2O content of 125.5 , 36.2 and 408.6 kg ha^{-1}, respectively. The experiment was laid out in split plot design with three replications comprising two sowing dates *i.e.*, 1st week and 3rd week of August, 2017 in main plot and four soybean varieties (JS 20-116, RVS 2010-1, PS 1556 and JS 97-52 as check) in sub-plot. The total rainfall received during crop growth period was 591.2 and 317.2 mm, for August 1st week and 3rd week sown crop, respectively. Fertilizer dose of 25:100:50:50 kg N-P_2O_5-K_2O-S ha^{-1} was applied at the time of sowing. Line sowing was done manually with a distance of 45 cm line to line and 10 cm between plants. Five plants were randomly selected for taking observation from each plot leaving the border rows from each side. Observations on growth parameters were taken at different growth stages of the crop by destructive sampling technique. Plant samples were collected at 15 days interval starting from 30 days after sowing (DAS) till 60 DAS, air dried and subsequently oven dried at 70^{o}C till a constant weight was achieved. The dry weight was recorded and expressed as g m^{-2}. Crop growth rate (CGR) represents the dry matter accumulation or increase in dry matter per unit of land area per unit of time and was calculated by using the formula given by Gregory (1962).

$$CGR = \frac{W_2 - W_1}{t_2 - t_1} \quad (g\ m^{-2}\ day^{-1})$$

Where W_2 and W_1 are the total dry weight of plants m^{-2} at time t_2 and t_1, respectively. Relative growth rate (RGR) is the increase in dry weight in unit time over unit weight of the plant and calculated by the following formula.

$$RGR = \frac{LnW_2 - LnW_1}{t_2 - t_1} \quad (g\ g^{-1}\ day^{-1})$$

Where W_2 and W_1 are the total dry weight of plants m^{-2} at time t_2 and t_1, respectively.

Grain production and rainfall use efficiency were calculated by using the following

formula

Grain production efficiency=

$$\frac{\text{Seed yield kg ha}^{-1}}{\text{Days to maturity}} \quad (\text{Kg ha}^{-1}\ \text{day}^{-1})$$

Rainfall use efficiency (RUE) =

$$\frac{\text{Seed yield kg ha}^{-1}}{\text{Rainfall during crop growth}} \quad (\text{Kg ha}^{-1}\ \text{mm}^{-1})$$

Results and Discussion

Growth parameters

The data on crop growth parameters presented in Table 1 indicated that date of sowing exerted significant effect on days to maturity, branches plant^{-1}, dry weight of plant m^{-2} and crop growth rate (CGR), while the effect on relative growth rate (RGR) was non significant. Days to maturity was higher (83 days) in August 1st week sown crop than August 3rd week sown crop(80 days). Maximum number of branches plant^{-1}(4.9) was recorded in earlier sowing. Higher dry weight of plant m^{-2} was recorded in August 1st week sowing (35.6, 87.8 and 161.0 g) than August 3rd week sowing (23.8, 64.0 and 123.2 g) at 30, 45 and 60 days after sowing (DAS), respectively. Dry matter accumulation increased progressively in each successive growth stage in both the dates of sowing. The CGR recorded between 30 to 45 DAS and 45 to 60 DAS followed the same trend as that of plant dry weight. The dry weight of plant m^{-2} was significantly influenced by different varieties of soybean in 30, 45 and 60 DAS and CGR in 30-45 DAS. The variety JS 20-116 recorded maximum branches plant^{-1}(4.9), dry weight of plant m^{-2} (35.4 g) at 30 DAS, 45 DAS (90.2 g) and 60 DAS (163.9 g) and was at par with RVS 2010-1 having 31.5, 79.9 and 148.5 g dry weight of plants m^{-2} at 30, 45 and 60 DAS, respectively.

Yield attributes

The dates of sowing exhibited significant effect on pods plant^{-1}, 100 seed weight, straw yield and RUE but did not affect harvest index (HI) and grain production efficiency (Table. 2). Maximum number of pods plant^{-1} and seed index of 34.8 and 11.85 g, respectively, was recorded in August 1st week sown crop whereas, sowing in 3rd week of August recorded 28.5 pods plant^{-1} and 9.99 g seed index. Decrease in number of pods plant^{-1} due to delay in sowing was also reported by Ahmad *et al. (*2010) in soybean. Straw yield was significantly higher (1958 kg ha^{-1}) in August 1st week sowing compared to 3rd week sowing (1429 kg ha^{-1}). However, maximum RUE was observed in late sowing (3.8 kg ha^{-1} mm^{-1}) than early sowing (2.4 kg ha^{-1} mm^{-1}). Among the varieties, JS 20-116 recorded maximum number pods plant^{-1} (36.0) and seed index (11.66 g) followed by RVS 2010-1 with 34.7 pods plant^{-1} and seed index of 11.34 g, respectively. Grain production efficiency(GPE) and Rainfall use efficiency i(RUE) were maximum in variety JS 20-116 i.e. 18.5 kg ha^{-1}day^{-1} and 3.7 kg ha^{-1} mm^{-1}, respectively, which was at par with RVS 2010-1 having 16.8 kg ha^{-1}day^{-1} GPE and 3.3 kg ha^{-1} mm^{-1} RUE.

Seed yield

Sowing in 1st week of August produced significantly higher seed yield (1417 kgha^{-1}) than late sowing (1200 kgha^{-1}) in 3rd week of August (Table. 3). Khan *et al*.,(2004) reported that, soybean cultivars gave maximum biological and seed yield in early planting than delay planting. Delayed sowing adversely affected the grain production.

Table.1 Effect of dates of sowing and varieties on growth parameters of soybean

Treatment	Days to maturity	Branches plant^{-1}	Dry weight plant^{-1} (g m^{-2})			CGR (g m^{-2} day^{-1})		RGR (g g^{-1} day^{-1})	
			30 DAS	45 DAS	60 DAS	30-45 DAS	45-60 DAS	30-45 DAS	45-60 DAS
Date of sowing									
1st week of August, 2017	83	4.9	35.6	87.8	161.0	7.10	9.99	0.06	**0.04**
3rd week of August, 2017	80	3.5	23.8	64.0	123.2	5.50	8.08	0.07	**0.04**
SE(m)±	0.3	0.21	1.5	3.1	2.6	0.21	0.09	0.002	**0.002**
CD at 5%	2.0	1.30	9.5	18.7	15.6	1.31	0.55	NS	**NS**
Variety									
JS 20-116	83	5.3	35.4	90.2	163.9	7.46	10.06	0.06	**0.04**
RVS 2010-1	81	4.4	31.5	79.9	148.5	6.59	9.37	0.06	**0.04**
PS 1556	82	3.9	28.4	72.8	135.5	6.06	8.54	0.06	**0.04**
JS 97-52 (check)	80	3.2	23.3	60.5	120.6	5.09	8.18	0.07	**0.05**
SE(m)±	0.6	0.24	2.0	4.6	9.2	0.36	1.34	0.001	**0.005**
CD at 5%	**1.9**	**0.74**	**6.2**	**14.1**	**28.4**	**1.12**	**NS**	**NS**	**NS**

Table.2 Effect of dates of sowing and varieties on yield and yield attributes of soybean

Treatment	Pods Plant^{-1}	Seed Index (g)	Straw yield (kg ha^{-1})	Seed yield (kg ha^{-1})	HI (%)	Grain production efficiency (GPE) (kg ha^{-1} day^{-1})	RUE (kg ha^{-1}-mm)
Date of Sowing							
1st week of August, 2017	34.8	11.85	1958	1417	41.9	16.9	**2.4**
3rd week of August, 2017	28.5	9.99	1429	1200	45.5	14.9	**3.8**
SE(m)±	0.73	0.30	80.1	32.8	1.44	0.34	**0.10**
CD at 5%	4.42	1.83	487.3	199.6	NS	NS	**0.63**
Variety							
JS 20-116	36.0	11.66	1950	1550	44.6	18.5	**3.7**
RVS 2010-1	34.7	11.34	1758	1367	43.9	16.8	**3.3**
PS 1556	30.0	11.11	1583	1267	44.9	15.3	**3.0**
JS 97-52 (check)	25.9	9.57	1483	1050	41.4	13.0	**2.5**
SE(m)±	2.55	0.23	89.6	67.2	1.06	0.78	**0.16**
CD at 5%	**7.87**	**0.72**	**276.0**	**207.0**	**NS**	**2.39**	**0.49**

Table.3 Effect of dates of sowing and varieties on seed yield (kg ha^{-1}) of soybean

Treatment	Seed yield (kg ha^{-1})		
Variety	**1st week of August, 2017**	**3rd week of August, 2017**	**Mean**
JS 20-116	1633	1467	1550
RVS 2010-1	1500	1233	1367
PS 1556	1367	1167	1267
JS 97-52 (check)	1167	933	1050
Mean	1417	1200	
	SEm±	**CD at 5%**	
Sowing date	32.8	199.6	
Varieties	67.2	207.0	
Interaction	NS	NS	

The increase in grain yield in early sowing dates is ascribed to higher number of pods per plant and higher seed index which corroborates the findings of Jaybhaye *et al*., 2015. The variety JS 20-116 recorded highest seed yield in both August 1st and 3rd week sowing with mean seed yield of 1550 kg ha^{-1} followed by RVS 2010-1 having mean seed yield of 1367 kg ha^{-1}. The seed yield in JS 20-116 and RVS 2010-1 was 47.6 and 30.2% higher than the check variety JS 97-52 (1050 kg ha^{-1}).

In conclusion, higher production of soybean can be achieved by sowing in 1st week of August which will avoid rainy days during maturity period. Amongst the four soybean varieties tested, JS 20-116 recorded the maximum seed yield in both the sowing dates followed by RVS 2010-1. Thus, sowing soybean variety JS 20-116 during 1st week of August will avoid rainy days during maturity period besides giving higher yield in Odisha.

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References

Ahmad, M., Anwar, M., Rahman, M. and Alam, M.(2010).Yield and yield components of soybean varieties as affected by different sowing dates. *American-Euresian Journal of Agronomy*. 3 (1) : 25-29.

Chauhan, G.S., Verma, N.S. and Bains, G.S. (1988). Effect of extrusion processing on the nutritional quality of protein in rice legume blends. *Nahrung*. 32(1):43-47.

Gregory, F.D. (1962). Effect of climatic conditions on growth of barley. *Annals of Botany* 40: 1-26.

Jasani, K.P., Patel, M.P. and Patel, H.P. (1993). Growth and yield of soybean as influenced by sowing period and seed rate. *Indian J. Agron.* 38 (4) : 670-672.

Jaybhaye, P. R., Shind, P. B. and Asewar, B. V.(2015). Response of soybean to sowing dates and spacing under rainfed condition. *International Journal of Tropical Agriculture*. 33 (2): 747-750.

Khan A.Z. Shah P, Khalil S. K. and Ahmed B., (2004). Yield of soybean cultivars as affected by planting date under Peshawar valley Conditions. *The Nucleus* 41:93-95.

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