

Crop Weather Relationship in Soybean

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ABSTRACT

A field experiment was conducted at ICAR Research Complex for N.E.H. Region, Barapani (Meghalaya) during 1995 and 1996, to find out the effect of weather parameter on different soybean cultivars at different dates of sowing. Results revealed that maximum pod yield was recorded at 1st May sown crop followed by subsequent dates of sowing at an interval of twenty days during both the year of experimentation. Maximum heat unit was accumulated at first date of sown crop, whereas minimum degree day and heat unit was accumulated at third date of sowing during both the year, respectively. It indicates that higher the temperature fastened the maturity and resulted in more production. Maximum grain was recorded in JS series cultivars but differences among different cultivars were not encouraging due their yielding capacity. There was little variation in degree day/heat unit accumulation among different cultivars. It is also interesting to note that interaction effect between date of sowing and different cultivars were found significant. There was significant difference between different cultivars on first and second dates of sowing over third date of sowing. Few spots of leaf rollere were observed during maximum vegetative stage but damage was negligible during second year resulting in a bit less yield.

Key words : Crop weather, Heat unit, Pod yield and Soybean.

Introduction

The heat unit or growing degree-day (GDD) concept assumes that there is direct and linear relationship between growth of plants and temperature. Soybean is a thermo-sensitive, long-day crop grown extensively throughout the world. The duration, growth and yield are primarily by thermal and photoperiod conditions experienced by the crop during its life cycle. The scientific way of assessing and qualifying the effect of temperature and photoperiod on plant growth, development and yield by applying GDD theory which advocates that the plants have a definite temperature requirement to pass through a certain growth portion or phenophase. The technique has widely been used to study the growth rate (Morrison and Mevelly, 1991), phenology (Kiniry *et al.*, 1983) and yield (Shukla and Vasuniya, 1998). Soybean [*Glycine max (L) Merr.*] is one of the important oil seed crops in India and its acreage and production are substantial in world but its productivity is quite low. Various biotic and abiotic factors play important role to decrease its productivity. Soybean has been introduced in Meghalaya recently and occupying an area of 4800 hectares of land under cultivation with an average

yield of 1146 kg/ha (Anonymous, 1994). Keeping above in view, a field experiment was conducted at ICAR Research Complex for NEH Region, Barapani (Meghalaya), to study the Crop Weather Relationship in Soybean.

Material and Methods

A field experiment was conducted to find out effect of weather parameters on different soybean cultivars at different dates of sowing during *khari* season of 1995 and 1996 under un-irrigated condition at ICAR Research Complex farm, Barapani (1180 m above msl.). The soil of the experimental site was sandy loam in texture, acidic in reaction (pH 5.1), having organic matter (2.5%), available phosphorus (52.3 ppm), available potash (192.5 ppm) and exchangeable calcium (5.2 meq/g), respectively. In both the years of experimentation, soybean was sown in the month of May/June and harvested in the 2nd week of October maintaining a spacing of 20 x 5 cm apart from row to row and plant to plant. Uniform dose of 30 kg N, 40 kg P₂O₅ and 40 kg K₂O/ha was applied to the crop at the time of sowing. There were twelve treatments combinations comprises of four varieties *viz.*, JS 80-21, JS 75-46, PK-472

and Durga and three dates of sowing during *kharif* season with a interval of 20 days (1st May, 20th May and 10th June) replicated thrice in randomized block design during both the year of experimentation. The crop observations at various phenological stages of growth were recorded and utilized in the present investigation. Maximum and minimum temperature data during crop growing season were collected from Automatic weather station of the Institute.

Results and Discussion

Effect of sowing date on yield attributes

The yield attributes like height of plant, number or branches, number and weight of pod per plant and straw yield influenced by the dates of sowing but the differences were non-significant except height of plant during first year of experimentation. Crop sown on 1st May, influenced the yield

attributing characters than subsequent dates of sowing, because higher accumulation of heat unit resulted in higher production. Crop sown on 20th May resulted in little reduction but 10th June sown crop resulted in minimum heat accumulation which, finally reflected on yield of the crop. Similar result was observed by Sharma and Shukla (1993).

Among the varieties maximum height of plant, number of branches/plant, number of pod/plant, weight of pod/plant and straw yield was recorded in JS 80-21 and JS 75-46 followed by Durga and PK-472 during both the year of experimentation but the differences were non-significant except height of the plant and straw yield during first year (Table 1). The results are in conformity with those of Bhatnagar and Tiwary (1990). It is interested to note that interaction effect was significant on some of the characters.

Table 1. Effect of sowing dates on yield attributing characters of soybean varieties

Treatments	Height of plant (cm)		Number of branches/plant		Number of pod/plant		Weight of pod/plant (gm)		Straw yield (q/ha)	
	1995	1996	1995	1996	1995	1996	1995	1996	1995	1996
Dates of sowing (D)										
D ₁ - (01.05.93)	114.2	58.6	7.1	5.4	66.8	58.5	10.9	20.7	25.0	32.8
D ₂ - (20.05.93)	98.6	51.8	6.3	5.0	66.2	55.7	10.7	19.6	19.7	30.1
D ₃ - (10.06.93)	61.2	47.6	5.1	4.9	54.6	48.2	9.2	13.7	16.3	23.1
S.E. (d)	25.05	92.99	0.41	0.32	32.82	51.10	1.69	18.9	0.55	2.7
C.D. at 5%	51.97	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	1.15	5.6
Varieties										
V ₁ - (JS 80-21)	112.2	58.9	6.7	5.2	80.5	58.5	15.2	23.2	22.6	27.0
V ₂ - (JS 75-46)	92.3	54.8	6.4	5.3	77.0	58.7	10.0	18.6	20.4	26.0
V ₃ - (PK 472)	73.3	46.8	5.6	4.9	43.1	42.0	7.5	12.3	19.6	19.5
V ₄ - (Durga)	87.7	50.0	5.9	5.0	49.6	57.2	8.4	17.7	18.7	21.5
S.E. (d)	33.4	10.2	0.58	0.43	32.82	68.13	2.25	50.0	1.74	2.5
C.D. at 5%	69.3	N.S.	N.S.	N.S.	N.S.	N.S.	4.67	N.S.	3.60	5.2

Effect of temperature

Effect of temperature is pronounced at different dates of sowing. Total growing degree-day accumulation was more at first dates of sowing followed by subsequent dates. Maximum growing degree day (1729 & 2080 °C) were accumulated at first date sown crop and minimum at third date of sowing. It is indicated that higher temperature fastened the maturity and contributed to the yield of the crop. Among the genotypes, maximum heat unit was accumulated in Durga (1561 & 2015 °C) and minimum in JS 80-21 and JS 75-46 (1524 & 1974 °C). It indicates that varieties, which are long duration, require more heat unit than short duration. No doubt, maximum grain was recorded in JS series varieties but differences among different

varieties were not encouraging due to their yielding capacity. There was little variation in degree day/heat unit accumulation among different varieties. Durga and PK-472 were accumulated more degree day/heat units during the total growth period than JS series cultivars during both the year of experimentation. The results are with agreement with those of Gay and Reocosky (1980).

Effect on pod yield

Results presented in Table 2 revealed that maximum pod yield (20.45 and 15.45 q/ha) was recorded at 1st May sown crop during first and second year followed by subsequent dates. There was significant variation among the different dates of sowing but first and second dates sown crop

Table 2. Effect of sowing dates on yield and growing degree day (GDD) of soybean varieties

Treatments	Grain yield (q/ha)		Degree day (°C)					
	1995	1996	1995	1996				
Dates of sowing (D)								
D ₁ - (01.05.03)	20.45	15.25	1729	2080				
D ₂ - (20.05.93)	18.78	14.75	1555	2003				
D ₃ - (10.06.93)	15.63	10.54	1345	1877				
S.Em	0.85	0.31	-	-				
C.D. at 5%	2.50	0.91	-	-				
Varieties								
V ₁ - (JS 80-21)	19.81	14.04	1524	1974				
V ₂ - (JS 75=46)	18.66	14.86	1535	1974				
V ₃ - (PK 472)	16.73	12.40	1550	1983				
V ₄ - (Durga)	17.95	12.77	1561	2015				
S.Em.	0.98	0.30	-	-				
C.D. at 5%	2.89	1.05	-	-				
Interaction								
Variety	Dates of sowing						Mean	
	D ₁		D ₂		D ₃		1995	1996
	1995	1996	1995	1996	1995	1996		
V ₁	15.38	21.55	15.21	20.05	11.55	17.83	14.04	19.81
V ₂	16.49	21.10	16.55	20.16	11.54	14.71	14.86	18.6
V ₃	13.93	19.44	13.66	15.88	9.60	14.88	12.40	16.73
V ₄	15.21	20.45	14.55	18.78	10.54	15.63	13.52	18.29
S.Em+	0.62	2.91	-	-	-	-	-	-
C.D. (5%)	1.83	N.S.	-	-	-	-	-	-

were found at par. It had been observed that during first year pod yield was more than second year because there was infestation of leaf roller during maximum vegetative stage resulted in less yield. There was significant variation among the different varieties during both the years. Maximum grain yield (19.81 q/ha) was recorded in JS 80-21 and minimum in PK-472 (16.73 q/ha) during first year whereas during second year maximum pod yield was recorded in JS 75-46 (14.86 q/ha) and minimum in PK-472 (12.40 q/ha), respectively. Gay and Reocosky (1980) also observed similar results. No doubt, maximum grain was recorded in JS series varieties but differences among different varieties were not encouraging due to their yielding capacity. It is also interesting to note that interaction effect between dates of sowing and different varieties were found significant. There was significant variation between different varieties on first and second dates of sowing over third date of sowing.

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