



RESPONSE OF DIFFERENT SOYBEAN VARIETIES UNDER DEFFERENT SOWING WINDOWS UNDER MARATHWADA REGION

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Abstract: A field experiment entitled “Response of different soybean (*Glycine max*) varieties under different sowing windows under marathwada region” was conducted at College of Agriculture, Vasantrya Naik Marathwada Krishi Vidyapeeth, Parbhani during Kharif season of 2016-17. During investigation the biometric observations viz. plant height, number of branches plant⁻¹, number of pods plant⁻¹ was significantly highest in 27th MW as compared to other sowing dates. The soybean variety V₁(MAUS-158) was highly productive as compare to other varieties V₂(MAUS-71), V₃ (MAUS-81) and V₄ (JS-335). The correlation study was carried out between weather variables prevailed during P₁ to P₁₀ growth stages of different cultivars under different sowing dates. The correlation coefficient between seed yield and weather variables prevailed in different phenophases of soybean cultivars. Rainfall, T_{min}, RH I, RH II and Wind velocity were positively correlated at P₂, P₃, P₄, P₆, P₈, P₉ and P₁₀ stages of soybean crop and BSS and Evaporation was negatively correlated at all growth stages except P₅ and P₇ of V₁ (MAUS-158), V₂ (MAUS-71), V₃ (MAUS-81) and V₄ (JS-335) cultivars of soybean crop

Key words: Sowing dates, Soybean varieties, RH, Evaporation, phenophases.

Introduction:

The meteorological parameters strongly influence the physiological expression and genetic potential of the crop hence play an important role in deciding the success or failure of the crop. Sowing date is variable with the largest effect on crop yield. Sowing windows is an important factor affecting soybean growth, development, and yield. (Zhang *et al.* 2010)

The number of days taken by D₁ sown crop for the maturity was highest and were gradually reduced with delay in sowings D₂ and D₃. The shortening of duration of various growth phases in the late sown crop might be the reason of reduction in total biomass. (Anil kumar *et al.* 2008). Delay in the sowing induced the early flowering in the soybean crop, as the day length increased along which increased temperature because of the crop is determinant type with short day length and

thermosensitive plant and its response to yield varies with variety of temperature (Khobragade *et al.* 2016).

Materials and Methods:

The investigation was carried out during kharif season of 2016, on the experimental farm, Department of Agricultural Meteorology, Vasantrya Naik Marathwada Krishi Vidyapeeth, Parbhani (19°16' N, 76° 47' E and 409.0 MSL) with an objective to find out the correlation between weather parameters on different phenophases and yield of soybean. The experiment was laid out in split plot design with four sowing dates viz. 27th MW, 28th MW, 29th MW and 30th MW as main plot treatments and four soybean cultivars viz. V₁-MAUS-158, V₂-MAUS-71, V₃ MAUS-81 and V₄-JS335 as sub plot treatments replicated thrice.

The 10 phenological stages from emergence to harvest were recorded and for each stage required specific number of days to attain that phase also

recorded. The 10 phenological stages are P1- Sowing to emergence, P2-Emergence to seedling, P3-Seedling to branching, P4- Branching to Flowering, P5- Flowering to pod formation, P6 -Pod formation to grain formation, P7-Grain formation to pod development, P8-Pod development to pod containing full size grain, P9- Pod containing full size grain to dough stage, P10-Dough stage to maturity. Simple correlations were worked out between weather parameters and resulted crop growth yield of soybean to work out parameters that affect qualitative relationship between them.

Results and Discussion:

Effect of dates of sowing and varieties on growth parameters:

The data on plant height was presented in Table-1 indicated that the mean plant height was influenced significantly by different dates of sowing. The crop sowed in D₁i.e. MW 27 recorded highest plant height than other treatments and was significantly superior over D₃i.e. MW 29 and D₄i.e. MW 30. But it was found at par with D₂i.e. MW 28. The cultivars V₁ (MAUS 158) recorded significantly highest plant height than other cultivars V₃ (MAUS 81) and V₄ (JS 335) but it was found at par with V₂ (MAUS-71).

The data on mean number of branches presented in Table-2 was influenced significantly by different dates of sowing at all stages. The highest number of branches recorded in D₁i.e. MW 27 was significantly superior over D₃i.e. MW 29, D₄i.e. MW 30 Sowing dates and it was found at par with D₂i.e. MW 28. The cultivars V₁i.e. MAUS 158 recorded highest number of branches than other cultivars V₃i.e. MAUS 81 and V₄i.e. JS-335 but it was found at par V₂i.e. MAUS-71.

The data pertaining to Mean number of pods plant⁻¹ presented in Table-3 was significantly highest in treatment D₁i.e. MW 27 and was significantly superior over other dates D₁i.e. MW 27, D₂i.e. MW 28 and D₃i.e. MW 29. The variety V₁ i.e. MAUS 158 recorded more pods than other varieties it was significantly superior over V₃i.e. MAUS 81 but it was

found at par with cultivars V₂i.e. MAUS-71 and V₄i.e. JS 335.

Similar result was also observed by Anil Kumar *et al.* (2008).

Effect of sowing dates and varieties on soybean yield:

The data regarding seed yield given in Table-4 was significantly influenced by different treatments crop sowed in D₁i.e. MW 27 recorded highest seed yield (i.e. 3021 kg ha⁻¹) and found to be significantly superior over other sowing dates D₁i.e. MW 27, D₂i.e. MW 28 and D₃i.e. MW 29. Among the varietal treatment, variety V₁i.e. MAUS 158 produced highest grain yield (i.e. 2611 kg ha⁻¹) and found significantly superior over cultivars V₃i.e. MAUS 81 and V₄i.e. JS 335 whereas it was at par with V₂i.e. MAUS 71.

In case with stalk yield crop sowed in D₁i.e. MW 27 recorded highest stalk yield (i.e. 2639 kg ha⁻¹) and found to be significantly superior over other sowing dates D₁i.e. MW 27, D₂i.e. MW 28 and D₃i.e. MW 29. Among the varietal treatments, cultivars V₄i.e. JS-335 produced higher stalk yield (i.e. 2150 kg ha⁻¹) and found to be non-significantly superior over V₁i.e. MAUS 158 i.e. (2033 kg ha⁻¹).

The data regarding biological yield was significantly influenced by different treatments crop sowed in D₁i.e. MW 27 recorded highest biological yield (i.e. 5660 kg ha⁻¹) and it was found that the significantly superior over other sowing dates D₁i.e. MW 27, D₂i.e. MW 28 and D₃i.e. MW 29. Among the varietal treatments, cultivars V₁ (MAUS 158) produced higher biological yield (i.e. 4644 kg ha⁻¹) and found that the non-significantly superior over V₃ (MAUS 81) i.e. (4332 kg ha⁻¹). Similar result was also observed by Anil Kumar *et al.* (2008).

Correlation between weather parameters and phenophases of soybean:

The correlation studies were undertaken to assess the impact of different variables prevailed during the crop life for the various phenological stages which were important in utilizing the weather resources for the synthesis of yield are considered. The correlation coefficient showing degree of

association between grain yield and weather variables prevailed during various phenophases of soybean. The data presented in Table-6-8 showed following observations

Rainfall has been positively correlated with seed yield at P₂, P₃, P₄, P₈, P₉ and P₁₀ however, it was negatively correlated at P₁, P₅ and P₇ stages of V₁(MAUS-158), V₂(MAUS-71), V₃(MAUS-81) and V₄ (JS-335) of soybean cultivars shown in table no. 21 to 24.

Temperature maximum has been positively correlated with seed yield at P₂, P₅, P₆, P₇ and P₁₀ however, it was negatively correlated at P₁, P₃, P₄, P₈

and P₉ stages of V₁ (MAUS-158), V₂ (MAUS-71), V₃ (MAUS-81) and V₄ (JS-335) of soybean cultivars shown in table no. 21 to 24. The Temperature minimum has been positively correlated with seed yield at P₂, P₃, P₈, P₉ and P₁₀ however, it was negatively correlated at P₇ stage of V₁ (MAUS-158), V₂ (MAUS-71), V₃ (MAUS-81) shown in table no. 21 to 24.

Relative humidity I and Relative humidity II has been positively correlated with seed yield at P₂, P₃, P₄, P₈, P₉ and P₁₀ however, it was negatively correlated at P₅ and P₇ stages of V₁ (MAUS-158), V₂ (MAUS-71), V₃ (MAUS-81) and V₄ (JS-335) of soybean cultivars.

Table 1: Mean periodical plant height (cm) of soybean as influenced by different treatments

Treatment	Days after sowing						At harvest
	15	30	45	60	75	90	
Date of sowing							
D ₁ (MW 27)	8.47	22.29	33.26	41.58	45.32	48.49	48.49
D ₂ (MW 28)	8.21	21.60	32.24	40.30	43.93	47.00	47.00
D ₃ (MW 29)	7.28	19.16	28.60	35.75	38.97	41.70	41.70
D ₄ (MW 30)	5.07	13.06	19.49	24.37	26.56	28.42	28.42
S.E. ±	0.17	0.45	0.67	0.83	0.91	0.97	0.97
C.D. at 5 %	0.51	1.33	1.98	2.47	2.69	2.88	2.88
Cultivar							
V ₁ (MAUS 158)	7.66	20.11	30.02	37.52	40.90	43.76	43.76
V ₂ (MAUS 71)	7.30	19.14	28.57	35.71	38.92	41.65	41.65
V ₃ (MAUS 81)	6.87	18.02	26.89	33.62	36.64	39.21	39.21
V ₄ (JS- 335)	7.20	18.84	28.12	35.15	38.31	40.99	40.99
S.E. ±	0.15	0.40	0.60	0.75	0.81	0.87	0.87
C.D. at 5 %	0.45	1.19	1.77	2.22	2.42	2.58	2.58
Interaction(D×V)							
S.E. ±	0.30	0.80	1.20	1.49	1.63	1.74	1.74
C.D. at 5 %	NS	NS	NS	NS	NS	NS	NS
G.Mean	7.26	19.03	28.40	35.50	38.69	41.40	41.40

Table 2: Mean number of branches plant⁻¹ of soybean as influenced by different treatments

Treatment	Days after sowing					At harvest
	30	45	60	75	90	
Date of sowing						
D ₁ (MW 27)	1.60	3.13	4.87	5.41	5.95	5.95
D ₂ (MW 28)	1.56	3.07	4.78	5.31	5.83	5.83
D ₃ (MW 29)	1.49	2.92	4.54	5.05	5.54	5.54
D ₄ (MW 30)	1.43	2.80	4.36	4.85	5.33	5.33
S.E. ±	0.02	0.05	0.07	0.08	0.08	0.08
C.D. at 5 %	0.07	0.13	0.21	0.23	0.25	0.25

Cultivar						
V ₁ (MAUS 158)	1.59	3.13	4.87	5.41	5.94	5.94
V ₂ (MAUS 71)	1.53	3.00	4.67	5.18	5.70	5.70
V ₃ (MAUS 81)	1.47	2.88	4.48	4.98	5.47	5.47
V ₄ (JS- 335)	1.49	2.91	4.54	5.04	5.54	5.54
S.E. \pm	0.03	0.06	0.10	0.11	0.12	0.12
C.D. at 5 %	0.10	0.19	0.29	0.33	0.36	0.36
Interaction(D\timesV)						
S.E. \pm	0.07	0.13	0.20	0.22	0.24	0.24
C.D. at 5 %	NS	NS	NS	NS	NS	NS
G. Mean	1.52	2.98	4.64	5.15	5.66	5.66

Table 3: Mean no. of pods plant⁻¹ of soybean influenced by different treatments

Treatment	Days after sowing			At harvest
	60	75	90	
Date of sowing				
D ₁ (MW 27)	23.60	41.60	60.80	60.80
D ₂ (MW 28)	18.83	36.83	56.03	56.03
D ₃ (MW 29)	16.08	32.62	51.81	51.81
D ₄ (MW 30)	11.00	22.80	43.00	43.00
S.E. \pm	1.24	1.48	1.48	1.48
C.D. at 5 %	3.68	4.40	4.39	4.39
Cultivar				
V ₁ (MAUS 158)	18.97	35.42	54.87	54.87
V ₂ (MAUS 71)	18.24	34.69	54.14	54.14
V ₃ (MAUS 81)	16.58	33.03	52.48	52.48
V ₄ (JS- 335)	15.72	30.71	50.16	50.16
S.E. \pm	0.655	0.97	0.97	0.97
C.D. at 5 %	1.94	2.88	2.88	2.88
Interaction(D\timesV)				
S.E. \pm	1.31	1.94	1.941	1.941
C.D. at 5 %	3.885	NS	NS	NS
G. Mean	17.37	33.46	52.91	52.91

Table 4: Mean seed yield (kg ha⁻¹), straw yield (kg ha⁻¹) and biological yield (kg ha⁻¹) of soybean as influenced by different treatments

Treatment	Seed yield kg ha ⁻¹	Straw yield kg ha ⁻¹	Biological yield kg ha ⁻¹	Harvest index %
Date of sowing				
D ₁ (MW 27)	3021	2639	5660	53.44
D ₂ (MW 28)	2515	2146	4660	53.94
D ₃ (MW 29)	2441	2162	4603	52.98
D ₄ (MW 30)	1741	1462	3203	54.25
S.E. \pm	56.19	96.06	94.00	1.39
C.D. at 5 %	166.70	51.41	278.90	NS
Cultivar				
V ₁ (MAUS 158)	2611	2033	4644	56.33
V ₂ (MAUS 71)	2454	2135	4589	53.53
V ₃ (MAUS 81)	2242	2090	4332	51.81

V ₄ (JS- 335)	2412	2150	4562	52.94
S.E. ±	59.09	51.40	83.56	0.86
C.D. at 5 %	175.33	NS	NS	2.57
Interaction(D×V)				
S.E. ±	118.18	102.81	167.12	1.734
C.D. at 5 %	NS	NS	NS	NS
G. Mean	2430	2102	4532	53.65

Table 5: Correlation coefficient between seed yield& weather parameters of V₁ (MAUS-158) cultivar

Weather Parameters	Phenophases of soybean									
	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇	P ₈	P ₉	P ₁₀
Rainfall (mm)	-0.403*	0.757**	0.828**	0.427**	-0.770**	0.015	-0.936**	0.714**	0.832**	0.778**
T _{MAX} (°C)	-0.755**	0.562**	-0.462**	-0.796**	0.917*8	0.452*8	0.967**	-0.895**	-0.898**	0.484**
T _{MIN} (°C)	0.195	0.619**	0.987**	0.234	-0.217	-0.078	-0.883**	0.948**	0.874**	0.960**
R. H. I (%)	-0.877**	0.336*	0.790**	0.337*	-0.938**	0.770**	-0.795**	0.450**	0.903**	0.755**
R. H. II (%)	0.569**	0.378*	0.872**	0.660**	-0.644**	-0.360*	-0.977**	0.911**	0.902**	0.841**
Evp (mm)	0.062	-0.193	-0.862**	-0.521**	0.885**	-0.183	0.945**	-0.644**	-0.981**	-0.411**
B. S. S. (hrs day ⁻¹)	-0.788**	-0.740**	-0.733**	-0.778**	0.758**	0.420**	0.996**	-0.906**	-0.873**	-0.831**
W. V. (kmh ⁻¹)	0.981**	-0.138	-0.595**	0.934**	0.688**	-0.018	0.248	0.851**	0.795**	-0.772**

Table 6: Correlation coefficient between seed yield and weather parameters of V₂ (MAUS-71) cultivar

Weather Parameters	Phenophases of soybean									
	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇	P ₈	P ₉	P ₁₀
Rainfall (mm)	-0.362*	0.739**	0.842**	0.459**	-0.760**	-0.034	-0.943**	0.713**	0.856**	0.796**
T _{MAX} (°C)	-0.783**	0.601**	-0.473**	-0.818**	0.902**	0.472**	0.978**	-0.893**	-0.918**	0.448**
T _{MIN} (°C)	0.228	0.614**	0.989**	0.281	-0.221	-0.120	-0.862**	0.942**	0.885**	0.972**
R. H. I (%)	-0.893**	0.333	0.819**	0.361*	-0.953**	0.782**	-0.781**	0.450**	0.910**	0.783**
R. H. II (%)	0.582**	0.382*	0.873**	0.693**	-0.637**	-0.405*	-0.986**	0.912**	0.920**	0.861**
Evp (mm)	0.057	-0.180	-0.879**	-0.551**	0.889**	-0.135	0.936**	-0.637**	-0.984**	-0.452**
B. S. S. (hrs day ⁻¹)	-0.782**	-0.752**	-0.735**	-0.807**	0.734**	-0.377*	0.997**	-0.909**	-0.896**	-0.835**
W. V. (kmh ⁻¹)	0.971**	-0.127	-0.591**	0.920**	0.713**	0.014	0.233	0.834**	0.822**	-0.764**

* Significant at 5%

** Significant at 1%

Table 7: Correlation coefficient between seed yield and weather parameters of V₃(MAUS-81) cultivar

Weather Parameters	Phenophases of soybean									
	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇	P ₈	P ₉	P ₁₀
Rainfall (mm)	-0.370*	0.868**	0.705**	0.265	-0.882**	-0.034	-0.970**	0.833**	0.831**	0.646**
T _{MAX} (°C)	-0.648**	0.487**	-0.601**	-0.684**	0.967**	0.472**	0.934**	-0.963**	-0.854**	0.607**
T _{MIN} (°C)	0.018	0.761**	0.992**	0.166	-0.393*	-0.120	-0.930**	0.992**	0.922**	0.905**
R. H. I (%)	-0.902**	0.512**	0.728**	0.150	-0.922**	0.782**	-0.898**	0.609**	0.953**	0.648**
R. H. II (%)	0.395*	0.542**	0.945**	0.550**	-0.782**	-0.405*	-0.954**	0.968**	0.900**	0.735**
Evp (mm)	0.257	-0.384*	-0.892**	-0.367*	0.946**	-0.135	0.990**	-0.782**	-0.989**	-0.291
B. S. S. (hrs day ⁻¹)	-0.663**	-0.828**	-0.843**	-0.701**	0.857**	-0.377*	0.989**	-0.963**	-0.820**	-0.704**
W. V. (kmh ⁻¹)	0.967**	-0.332	-0.433**	0.976**	0.739**	0.014	0.435**	0.929**	0.711**	-0.883**

Table 8: Correlation coefficient between seed yield and weather parameters of V₄(JS-335) cultivar

Weather Parameters	Phenophases of soybean									
	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇	P ₈	P ₉	P ₁₀
Rainfall (mm)	-0.368*	0.787**	0.801**	0.396*	-0.805**	0.009	-0.956**	0.757**	0.851**	0.750**
T _{MAX} (°C)	-0.741**	0.565**	-0.518**	-0.777**	0.929**	0.506**	0.968**	-0.921**	-0.901**	0.505**
T _{MIN} (°C)	0.158	0.666**	0.995**	0.242	-0.280	-0.058	-0.890**	0.964**	0.902**	0.954**
R. H. I (%)	-0.900**	0.394*	0.792*8	0.292	-0.947**	0.808**	-0.825**	0.506**	0.929**	0.741**
R. H. II (%)	0.522**	0.437**	0.901**	0.648**	-0.689**	-0.379*	-0.980**	0.936**	0.917**	0.823**
Evp (mm)	0.124	-0.249	-0.887**	-0.492**	0.913**	-0.166	0.959**	-0.689**	-0.991**	-0.399*
B. S. S. (hrs day ⁻¹)	-0.747**	-0.781**	-0.775**	-0.775**	0.780**	-0.394*	0.999**	-0.932**	-0.875**	-0.796**
W. V. (kmh ⁻¹)	0.975**	-0.196	-0.542**	0.944**	0.725**	-0.058	0.302	0.871**	0.788**	-0.808**

* Significant at 5%

** Significant at 1%

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