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Research Article

Growth and Yield of Soybean Varieties as Influenced by Different Soybean Varieties and Sowing Windows

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ABSTRACT

An experiment "Micrometeorological studies on growth, yield and pest infestation on soybean varieties under different sowing windows" was carried out at Faculty of Agriculture Department of Agricultural Meteorology Farm, Centre for Advanced Agricultural Meteorology, College of Agriculture, Pune during Kharif seasons of 2015 and 2016.

The experiment was laid out in split plot design with three replications. The treatments comprised of four soybean varieties viz., V_1: MACS- 450, V_2: JS- 335, V_3: DS – 228 (Phule Kalyani) and V_4: KDS- 344 (Phule Agrani) as main plot and four sowing windows viz., D_1: 26th MW (25 June -1 July), D_2: 27th MW (2 July-8 July), D_3: 28th MW (9 July – 15 July) and D_4: 29th MW (16 July -22 July) as sub plot treatments.

Keywords: *Kharif, MW, Soybean, Sowing windows.*

INTRODUCTION

Sowing date is the variable with the largest effect on crop yield. Planting date is an important factor affecting soybean growth, development, yield, and grain quality. (Zhang et al., 2000). Delayed planting date and unfavorable environmental conditions have a negative effect on soybean growth, development and yield.

Delayed sowing generally shifts reproductive growth into less favourable conditions with shorter days, lower radiation and temperatures. Photoperiod affects soybean growth and development through its life cycle. Photoperiod along with other environmental factors and all interactivities involved contributes to the control of the ratio of the crops vegetative to reproductive components.

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Day length is the key factor in most of the soybean varieties as they are short day plant and are sensitive to photoperiods.

Most of the varieties will flower and mature quickly when grown under conditions where day length is less than 14 hours (Ghadekar, 2001). Reduced light intensity decreased number of flowers and number of pods (minimum at anthesis stage) resulting in decrease in yield. The higher relative humidity during flowering phase might have helped in proper seed setting by overcoming the pollen desiccation and thereby in good seed yield and lower temperature during flowering period increased productivity of soybean (Kumar et al., 2008).

MATERIAL AND METHODS

The field experiment was conducted at Department of Agricultural Meteorology Farm, College of Agriculture, Pune during *kharif* seasons of 2015 and 2016. The experiment was conducted in a split plot design with three replications. The treatments were allotted randomly to each replication by keeping the gross plot size 5.4 x 3.6 m^2 and net plot size 4.5 x 2.7 m^2 with 45 x 5 cm spacing. There were sixteen treatment combinations, The treatments comprised of four varieties *viz.*, V_1: MACS- 450, V_2: JS- 335, V_3: DS – 228 (Phule Kalyani) and V_4: KDS- 344 (Phule Agrani) as main plot and four sowing windows *viz.*, D_1: 26th MW (25 June -1 July), D_2: 27th MW (2 July-8 July), D_3: 28th MW (9 July – 15 July) and D_4: 29th MW (16 July -22 July) as sub plot treatments.

RESULTS AND DISCUSSION

Yield attributes studies

Number of pods plant^{-1}

Effect of Varieties

The variety DS-228 (V_3) recorded maximum number of pods plant^{-1} (49.70 and 47.71) that was significantly more over varieties JS- 335 (V_2) (43.89 and 41.73), KDS- 344 (V_4) (39.47 and 36.31) and MACS- 450 (V_1) (37.16 and 33.19). Similar results were reported by Katti et al. (1970).

Effect of sowing windows

Sowing windows significantly influenced the number of pods plant^{-1}. During 2015, sowing in 26th MW (D_1) (50.28) recorded significantly higher number of pods plant^{-1} compared to late sowings in the 29th MW (D_4). The lowest number of pods plant^{-1} were recorded by sowing in the 29th MW (D_4) (34.10). Similarly, during 2016, sowing in the 26th MW (D_1) (47.08) recorded significantly higher number of pods plant^{-1} as compared to sowings in the 27th MW (D_2), 28th MW (D_3) and 29th MW (D_4) and the lowest number of pods plant^{-1} were recorded in the last sowing window (D_4) (31.59). The above results are in conformity with the findings reported by Barik and Sahoo (1989), Jasani et al. (1994), Park et al. (2000), Singh et al. (2010) and Mane (2011).

Interaction effects

The interaction effect between soybean varieties with different sowing windows were found significant in case of number of pods plant^{-1}. The sowing of DS- 228 variety during 26th MW i.e. V_3 D_1 recorded higher number of pods plant^{-1} (61.69 and 59.22). This was followed by variety JS- 335 (54.82 and 52.13), KDS- 344 (41.40 and 38.09) and MACS- 450 (43.21 and 38.89) during 2015 and 2016, respectively.

Table 1: Yield attributes at harvest influenced as by different treatments (2015 and2016)

Treatment	Number of pods plant $^{-1}$			Pod weight plant^{-1}		
	2015	2016	Pooled	2015	2016	Pooled
A) Main plot: Varieties						
V_1:MACS-450	37.16	33.19	35.17	10.79	9.71	10.25
V_2:JS-335	43.89	41.73	42.81	12.74	12.12	12.43
V_3:DS-228	49.70	47.71	48.71	14.43	13.86	14.14
V_4:KDS-344	39.47	36.31	37.89	11.46	10.54	11.00
S. Em±	1.37	1.39	1.69	0.40	0.38	0.48
C.D. at 5%	4.75	4.80	5.21	1.38	1.32	1.47
B) Sub plot: Sowing windows						
D_1: 26thMW	50.28	47.08	48.68	14.60	13.67	14.14
D_2: 27thMW	47.79	44.72	46.25	13.88	12.98	13.43
D_3: 28th MW	38.04	35.54	36.79	11.05	10.32	10.68
D_4: 29th MW	34.10	31.59	32.85	9.90	9.25	9.58
S. Em±	0.95	0.90	1.13	0.28	0.26	0.33
C.D. at 5%	2.77	2.63	3.22	0.80	0.76	0.94
C) Interaction (A × B)						
V_1D_1	43.21	38.89	41.05	12.55	11.29	11.92
V_1D_2	42.90	38.61	40.76	12.46	11.21	11.83
V_1D_3	33.26	29.93	31.60	9.66	8.69	9.18
V_1D_4	29.25	25.33	27.29	8.49	7.64	8.07
V_2D_1	54.82	52.13	53.48	15.92	15.14	15.53
V_2D_2	51.24	48.70	49.97	14.88	14.14	14.51
V_2D_3	38.55	36.66	37.60	11.19	10.64	10.92
V_2D_4	30.93	29.41	30.17	8.98	8.54	8.76
V_3D_1	61.69	59.22	60.45	17.91	17.20	17.55
V_3D_2	57.70	55.40	56.55	16.75	16.09	16.42
V_3D_3	41.65	39.98	40.82	12.10	11.61	11.86
V_3D_4	37.76	36.24	37.00	10.96	10.53	10.75
V_4D_1	41.40	38.09	39.75	12.02	11.06	11.54
V_4D_2	39.30	36.15	37.72	11.41	10.50	10.95
V_4D_3	38.70	35.60	37.15	11.24	10.34	10.79
V_4D_4	38.47	35.39	36.93	11.17	10.28	10.73
S. Em±	2.14	2.09	2.59	0.62	0.59	0.74
C.D. at 5%	6.73	6.60	7.63	1.95	1.86	2.19
Mean	42.55	39.73	41.14	12.36	11.56	11.96

Pod weight plant^{-1} (g)

Effect of varieties

The mean pod weight plant^{-1} (g) influenced due to varieties were significant during both the years of 2015 and 2016. It could be observed that variety DS- 228 (V_3) recorded significantly higher mean pod weight plant^{-1} (14.43 and 13.86 g) as compared to variety JS-335 (V_2) (12.74 and 12.12 g), KDS- 344 (V_4) (11.46 and 10.54 g) and the lowest pod weight per plant was observed in MACS- 450 (V_1) (10.79 and 9.71 g) at harvest during both the years. These results are in conformity with the findings of Billore et al. (2000), Kathmale et al. (2013) and Tupe (2015).

Effect of sowing windows

The mean pod weight plant^{-1} (g) was significantly influenced by different sowing windows. The significantly higher mean pod weight plant^{-1} (g) was recorded with sowing of soybean during 26th MW (D_1) at harvest than rest of the sowing windows. The mean pod weight plant^{-1} (g) showed decreasing trend with later sowings (D_1 to D_4). Statistically the higher mean pod weight plant^{-1} (14.60 and 13.67 g) was recorded with 26th MW (D_1) sowing. This was closely followed by treatment D_2 i.e. sowing during 27th MW (13.88 and 12.98 g) which registered statistically higher mean pod weight plant^{-1} than D_3 (28th MW). Thereafter, D_4 (29th MW) produced significantly lower mean pod weight plant^{-1} (9.90 and 9.25 g) during both the years of 2015 and 2016, respectively. This might be due to late sowing exposed to abiotic stresses which ultimately reflected in lower seed

weight. These results are in conformity with the findings of Ahmed et al. (2010), Bhatia et al. (1999), Singh (2013) and Tupe (2015).

Interaction effects

The interaction effect between soybean varieties with different sowing windows were found to be significant in all the stages of crop. The sowing of DS- 228 variety during 26th MW i.e. V_3 D_1 recorded higher number of pods plant^{-1} (17.91 and 17.20). This was followed by variety JS- 335 (15.92 and 15.14), KDS- 344 (12.02 and 11.06) and MACS- 450 (12.55 and 11.29) during 2015 and 2016, respectively.

Number of grains plant^{-1}

Effect of varieties

The mean number of grains plant^{-1} influenced due to varieties were significant during both the years. It could be observed that variety DS- 228 (V_3) recorded significantly higher mean number of grains plant^{-1} (120.26 and 114.88) as compared to variety JS- 335 (V_2) (103.69 and 100.96), KDS- 344 (V_4) (88.75 and 88.42) and the lowest number of grains per plant^{-1} were observed in MACS- 450 (V_1) (89.91 and 80.92) at harvest during both the years respectively. These results are in conformity with the findings of Billore et al. (2000), Kathmale et al. (2013) and Tupe (2015).

Effect of sowing windows

The mean number of grains plant^{-1} were significantly influenced by different sowing windows. The significantly higher mean number of grains plant^{-1} were recorded with sowing of soybean during 26th MW (D_1) at harvest than rest of the sowing windows. The mean number of grains plant^{-1} showed decreasing trend with later sowings (D_1 to D_4). Statistically the highest mean number of grains plant^{-1} (121.67 and 114.49) were recorded with 26th MW (D^1) sowing.

This was closely followed by treatment D_2 i.e. sowing during 27th MW (115.63 and 108.20) which recorded statistically higher mean number of grains plant^{-1} than D_3 (28th MW) (82.79 and 86.01). Thereafter, D_4 (29th MW) produced significantly lower number of grains plant^{-1} (82.52 and 76.49) during both the years 2015 and 2016, respectively. Early sowing date produced higher seed number, pod number and harvest index than the later sowing windows. These results are in conformity with the findings of Bhatia et al. (1999).

Effect of interaction

Interaction effects between varieties and sowing window had significant influence on number of grains plant^{-1} at harvest. The sowing of DS- 228 variety during 26th MW i.e. V_3 D_1 recorded higher number of pods plant^{-1} (149.27 and 143.30). This was followed by variety JS- 335 (132.65 and 126.14), KDS- 344 (100.18 and 94.42) and MACS- 450 (104.56 and 94.10) during 2015 and 2016, respectively.

Weight of grains plant^{-1} (g)

Effect of Varieties

The mean weight of grains plant^{-1} influenced due to varieties were significant during both the years 2015 and 2016. It could be observed that variety DS- 228 (V_3) recorded significantly higher mean weight of grains plant^{-1} (12.72 and 12.21 g) as compared to variety JS- 335 (V_2) (10.68 and 10.96 g), KDS- 344 (V_3) (10.10 and 9.27) and the lowest weight of grains per plant^{-1} was observed in MACS- 450 (V_1) (9.51 and 8.56) at harvest during both the years, respectively. These results are in conformity with the findings of Billore et al. (2000), Kathmale et al. (2013) and Tupe (2015).

Effect of sowing windows

The mean weight of grains plant^{-1} were significantly influenced by different sowing windows. Significantly higher mean weight of grains (g) plant^{-1} was recorded with sowing of soybean during 26th MW (D_1) at harvest than rest of the sowing windows. The mean weight of grains plant^{-1} (g) showed decreasing trend with later sowings (D_1 to D_4). Statistically the highest mean weight of grains plant^{-1} (g) (12.87 and 12.05 g) was recorded with 26th MW (D_1) sowing. This was closely followed by treatment (D_2) i.e. sowing during 27th MW (12.23 and 11.42 g) which registered statistically higher mean weight of grains plant^{-1} (g) than (D_3) (28th MW) (9.74 and 9.10 g). Thereafter, (D_4) (29th MW) produced

significantly lower values for mean weight of grains plant^{-1} (8.73 and 8.15 g) during both the years 2015 and 2016, respectively. It might be due to weather parameters which also played the role in deciding the final seed weight between days taken and GDD required. The higher relative humidity (91%) during the flowering phase might have helped in proper seed setting by overcoming the pollen desiccation and there by good seed yields and lower temperature during the flowering period increased the productivity of soybean. These results are in conformity with the findings of Ahmed et al. (2010), Singh (2013) and Tupe (2015).

Effect of interaction

Interaction effects between varieties and sowing windows had significant influence on weight of grains plant^{-1} (g) at harvest during both the years 2015 and 2016. Sowing during 26th MW (D_1) recorded higher weight of grains plant^{-1} in variety DS- 228 (15.79 and 15.16 g) during 2015 and 2016, respectively, followed by variety JS- 335 (14.03 and 13.35 g), KDS-344 (10.60 and 9.75 g) and MACS- 450 (11.06 and 9.96 g). In all the sowing windows, DS-228 was superior to all other varieties and 26th MW sowing window recorded the higher weight of grains plant^{-1}

Table 2: Yield attributes at harvest influenced as by different treatments (2015 &2016)

Treatment	Number of grains plant $^{-1}$			Weight of grains plant $^{-1}$ (g)		
	2015	2016	Pooled	2015	2016	Pooled
A) Main plot: Varieties						
V_1:MACS-450	89.91	80.92	85.41	9.51	8.56	9.04
V_2:JS-335	103.69	100.96	102.33	11.23	10.68	10.96
V_3:DS-228	120.26	114.88	117.57	12.72	12.21	12.47
V_4:KDS-344	88.75	88.42	88.58	10.10	9.27	9.69
S. Em±	4.58	2.84	4.67	0.35	0.34	0.43
C.D. at 5%	15.84	9.83	14.37	1.22	1.19	1.31
B) Sub plot: Sowing window						
D_1: 26thMW	121.67	114.49	118.08	12.87	12.05	12.46
D_2: 27thMW	115.63	108.20	111.91	12.23	11.42	11.83
D_3: 28th MW	82.79	86.01	84.40	9.74	9.10	9.42
D_4: 29th MW	82.52	76.49	79.51	8.73	8.15	8.44
S. Em±	3.98	2.21	3.94	0.24	0.23	0.29
C.D. at 5%	11.61	6.46	11.21	0.71	0.67	0.82
C) Interaction (A × B)						
V_1D_1	104.56	94.10	99.33	11.06	9.96	10.51
V_1D_2	103.81	93.43	98.62	10.98	9.89	10.44
V_1D_3	80.48	72.43	76.46	8.51	7.66	8.09
V_1D_4	70.78	63.71	67.25	7.49	6.74	7.12
V_2D_1	132.65	126.14	129.40	14.03	13.35	13.69
V_2D_2	123.99	117.84	120.91	13.12	12.47	12.79
V_2D_3	83.27	88.69	85.98	9.87	9.38	9.63
V_2D_4	74.85	71.17	73.01	7.92	7.53	7.72
V_3D_1	149.27	143.30	146.28	15.79	15.16	15.48
V_3D_2	139.63	134.04	136.83	14.77	14.18	14.48
V_3D_3	100.78	96.75	98.77	10.66	10.24	10.45
V_3D_4	91.36	85.45	88.40	9.66	9.28	9.47
V_4D_1	100.18	94.42	97.30	10.60	9.75	10.18
V_4D_2	95.08	87.47	91.28	10.06	9.16	9.61
V_4D_3	66.64	86.15	76.39	9.91	9.11	9.51
V_4D_4	93.09	85.64	89.36	9.85	9.06	9.45
S. Em±	8.27	4.77	8.27	0.55	0.52	0.66
C.D. at 5%	NS	14.84	NS	1.72	1.65	1.93
Mean	100.65	96.30	98.47	10.89	10.18	10.54

Grain yield (kg ha^{-1})

Effect of Varieties

The results were highly consistent during both the years 2015 and 2016. During 2015, Soybean variety DS- 228 (V_3) recorded significantly higher seed yield (29.7 kg ha^{-1}) over JS- 335 (V_2) (26.1 kg ha^{-1}), KDS- 344 (V_4) (23.5 kg ha^{-1}) and MACS- 450 (V_1) (22.2). Similar trend of grain yield were observed during the year 2016, DS- 228 (V_3) recorded significantly higher seed yield (28.5 kg ha^{-1}) over JS- 335 (V_2) (24.9 kg ha^{-1}) and KDS- 344 (V_4) (21.7 kg ha^{-1}) and MACS- 450 (V_1) (19.9). Differences in yield among the varieties might be due to genetic potential of the genotypes. Higher grain yield in DS- 228 (V_3) might be due to higher light interception also. Similar results were reported by Lingaraju et al. (1995), Board et al. (1997), Bhatia et al. (1999) and Jadhao (2009).

Effect of sowing windows

The mean grain yield was significantly influenced by different sowing windows. Significantly the higher mean grain yield was recorded with the sowing of soybean during 26th MW (D_1) than rest of the sowing windows. The mean grain yield showed decreasing trend with later sowings (D_1 to D_4). Statistically the higher mean grain yield of 30 and 28.1 kg ha^{-1} was recorded with 26th MW (D_1) sowing. This was closely followed by treatment D_2 i.e. sowing during 27th MW (28.5 and 26.7 kg ha^{-1}) which registered statistically higher mean grain yield (kg ha^{-1}) than D_3 (28th MW) (22.7 and 21.2) (kg ha^{-1}), followed by D_4 (29th) MW (20.3 and 19.0)

Effect of interaction

Interaction effect between soybean varieties and sowing windows were significant for grain yield. Soybean variety DS- 228 sown during 26th MW (V_3 D_1) recorded significantly higher pooled grain yield 36.1 kg ha^{-1} (36.8kg ha^{-1} in 2015 and 35.3 kg ha^{-1} in 2016).

This was followed by variety JS- 335 31.8 kg ha^{-1} (32.5 kg ha^{-1}in 2015 and 31.1 kg ha^{-1} in 2016), KDS- 344 23.7 kg ha^{-1} (24.7 kg ha^{-1} in 2015 and 22.7 kg ha^{-1} in 2016) and MACS- 450 24.5 kg ha^{-1} (25.8 kg ha^{-1} in 2015 and 23.2 kg ha^{-1} in 2016). These results showed that the delay in sowing of soybean varieties could not able to assimilate the more biomass as result reduced grain yield of soybean. The delayed sowing windows reduced the yields of all the varieties.

Straw Yield:

Effect of varieties:

The straw yield of soybean was influenced significantly due to soybean varieties. The straw yield was significantly higher in DS- 228 35.0 kg ha^{-1} (35.7 kg ha^{-1} in 2015 and 34.3 kg ha^{-1} in 2016) which was significantly superior over rest of the sowing windows, followed by JS- 335 30.8 kg ha^{-1} (31.6 kg ha^{-1} in 2015 and 30.0 kg ha^{-1} in 2016), KDS- 344 27.3 kg ha^{-1} (28.4 kg ha^{-1} in 2015 and 26.1 kg ha^{-1} in 2016) and MACS- 450 25.4 kg ha^{-1} (26.7 kg ha^{-1} in 2015 and 24.0 kg ha^{-1} in 2016). Differences in straw yields might be due to genetic potential of the genotypes. Similar results were reported by Lingaraju et al. (1995), Board et al. (1997), Bhatia et al. (1999), Jadhao (2009) and Kathmale et al. (2013).

The mean straw yield were significantly influenced by different sowing windows. Significantly the higher mean straw yield were recorded with sowing of soybean during 26th MW (D_1) than rest of the sowing windows. The mean straw yield showed decreasing trend with later sowing windows (D_1 to D_4). Statistically the highest mean straw yield of 36.2 and 33.9 kg ha^{-1} was recorded with 26th MW (D_1) sowing during 2015 and 2016, respectively. This was closely followed by treatment D_2 i.e. sowing during 27th MW (34.4 and 32.2 (kg ha^{-1})) at harvest registered statistically higher mean straw yield (kg ha-^{1}) than D_3 (28th MW) (27.4 and 25.6). Thereafter, D_4 (29th MW) produced significantly lower values for mean straw yield (24.5 and 22.9 kg ha^{-1}) during both the years of 2015 and 2016, respectively. It might be due to crop exposed to better climatic conditions particularly APAR, LUE and photoperiod which resulted

in higher photosynthetic rate and consequently reflected in superiority in growth attributes and dry matter accumulation which resulted in higher straw yield. These results are in conformity with the findings of Ahmed et al. (2010), Bhatia et al. (1999), Singh (2013) and Tupe (2015).

Table 3: Grain yield and straw yields as influenced by different treatments

Treatment	Grain yield (kg ha^{-1})			Straw yield (kgha^{-1})		
	2015	2016	Pooled	2015	2016	Pooled
A) Main plot: Varieties						
V_1:MACS-450	22.2	19.9	21.1	26.7	24.0	25.4
V_2:JS-335	26.1	24.9	25.5	31.6	30.0	30.8
V_3:DS-228	29.7	28.5	29.1	35.7	34.3	35.0
V_4:KDS-344	23.5	21.7	22.6	28.4	26.1	27.3
S. Em±	0.82	0.78	0.98	0.99	0.94	1.18
C.D. at 5%	2.84	2.70	3.02	3.41	3.24	3.63
B) Sub plot: Sowing window						
D_1: 26thMW	30.0	28.1	29.0	36.2	33.9	35.0
D_2: 27thMW	28.5	26.7	27.6	34.4	32.2	33.3
D_3: 28th MW	22.7	21.2	21.9	27.4	25.6	26.5
D_4: 29th MW	20.3	19.0	19.7	24.5	22.9	23.7
S. Em±	0.57	0.54	0.68	0.69	0.65	0.82
C.D. at 5%	1.66	1.57	1.93	2.01	1.91	2.34
C) Interaction (A × B)						
V_1D_1	25.8	23.2	24.5	31.1	28.0	29.5
V_1D_2	25.6	23.0	24.3	30.9	27.8	29.3
V_1D_3	19.8	17.8	18.8	23.9	21.5	22.7
V_1D_4	17.4	15.7	16.6	21.0	18.9	20.0
V_2D_1	32.5	31.1	31.8	39.4	37.5	38.5
V_2D_2	30.6	29.1	29.8	36.9	35.0	36.0
V_2D_3	23.0	21.9	22.4	27.7	26.3	27.0
V_2D_4	18.4	17.5	18.0	22.2	21.1	21.7
V_3D_1	36.8	35.3	36.1	44.4	42.6	43.5
V_3D_2	34.4	33.1	33.8	41.5	39.8	40.7
V_3D_3	24.8	23.9	24.4	30.0	28.8	29.4
V_3D_4	22.5	21.6	22.1	27.1	26.0	26.6
V_4D_1	24.7	22.7	23.7	29.8	27.4	28.6
V_4D_2	23.4	21.6	22.5	28.3	26.0	27.1
V_4D_3	23.1	21.2	22.2	27.9	25.6	26.7
V_4D_4	22.9	21.1	22.0	27.7	25.5	26.6
S. Em±	1.28	1.2	1.5	1.5	1.4	1.8
C.D. at 5%	4.03	3.82	4.50	4.86	4.61	5.43
Mean	25.42	23.78	24.60	30.65	28.67	29.66

Effect of interaction

Interaction effect between soybean varieties and sowing windows were significant for straw yield. A soybean variety DS- 228 sown during 26th MW recorded significantly higher straw yield of 43.5 kg ha^{-1} (44.4 kg ha^{-1} in 2015 and 42.6 kg ha^{-1} in 2016), followed by variety JS- 335 with 38.5 kg ha^{-1}(39.4 kg ha^{-1} in 2015 and 37.5 kg ha^{-1} in 2016), KDS- 344 28.6 kg ha^{-1} (29.8 kg ha^{-1} in 2015 and 27.4 kg ha^{-1} in 2016) and MACS- 450 29.5 kg ha^{-1} (31.1 kg ha^{-1} in 2015 and 28.0 kg ha^{-1} in 2016). These results showed that delay in sowing of soybean varieties could not able to assimilate the more biomass resulted in reduced straw yield of soybean.

CONCLUSION

All the biometric observations initial and final plant count, plant height, number of branches, number of leaves, leaf area, leaf area index, dry matter accumulation, yield parameters number of pods $plant^{-1}$,pod weight $plant^{-1}$, number of grains $plant^{-1}$, weight of grain pod^{-1}, 100 seed weight, grain, straw and biological yield, harvest index and micrometeorological observations recorded were significantly the highest in variety DS-228 (V_3) than the variety JS- 335 (V_2) in early sowing during (D_1) 26th MW followed by (D_2) 27th MW, (D_3) 28th MW and (D_4) 30th MW.

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