

Original Research Article

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## Evaluation of Soybean (*Glycine max* L.) Varieties in Post-monsoon for Growth and Yield Performance under Varied Weather Conditions

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### ABSTRACT

#### Keywords

AGR, RGR,  
Harvest index,  
Sowing dates,  
Soybean, etc.

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The experiment was conducted in post-monsoon season (2017-2018) at Department of Agronomy, Vasantrya Naik Marathwada Krishi Vidyapeeth, Parbhani. The experiment was laid out in Split plot design with three replications comprising three sowing dates i.e. 38<sup>th</sup> MW, 39<sup>th</sup> MW and 40<sup>th</sup> MW as main-plot treatments and four varieties consists of JS-9560, MAUS-612, MAUS-162, MAUS-71 as sub-plot treatments. Data were collected on seed yield, biological yield as yield components of soybean and analyzed statistically. From these it observed that the growth parameters Viz., AGR, RGR and yield were higher in early sowing as compared to the late sowing. Among the varieties JS-9560 and MAUS-612 performed significantly higher for seed yield and harvest index.

### Introduction

Soybean is the only major crop that has witnessed on impressive expansion in acreage and production of the global level. India rank 5<sup>th</sup> in area (109.71 lakh ha) and production (108.78 lakh MT) whereas Maharashtra ranks 2<sup>nd</sup> for area and production which are 36.05 lakh MT and 1007 kg ha<sup>-1</sup> respectively during *kharif* 2016 (Anonymous, 2016).

Sowing date is an important factor and a least expensive cultural consideration that impacts soybean seed yield and quality. Fine-tune management of soybean with sowing date is a

good approach to improve growth and development, and to enhance the yield potential with good quality seed. Different varieties of soybean are sensitive to change in environmental conditions where the crop is grown. Therefore, it is necessary to study the genotype X environment interaction to identify the varieties which are stable in different environments (Seyyed and Seyyed, 2013). Delayed sowing generally shifts reproductive growth due to less favourable conditions with shorter days, lower radiation and temperatures. In Maharashtra, cultivation of soybean is mainly as rainfed crop. The agro-climatic conditions of *kharif* season are

found suitable to soybean as commercial crop. However climatic conditions may cause the adverse effect on seed production of different soybean varieties in *kharif* season.

To overcome these problems and to become self sufficient in the availability of quality seed to the farming community, it becomes essential to ascertain whether the sowing of soybean can be extended up to *post-monsoon* season by treating newly developed varieties of different duration during this extended period of sowing for seed yield and quality. If the seed production of soybean becomes successful in *post-monsoon*, the same seed can be made available for succeeding *summer* and *kharif* season also. The varieties viz., JS-9560, MAUS-612, MAUS-162 and MAUS-71 were therefore proposed for testing during *post-monsoon* with sowing span of 38<sup>th</sup> MW (17-23 Sept.) to 40<sup>th</sup> MW (01-07 Oct.) with the objectives to find out suitable date of sowing for *post-monsoon* soybean and to evaluate the performance of different soybean varieties in *post-monsoon* season along with to study the interaction between sowing time and varieties in post monsoon soybean.

## Materials and Methods

The experiment was conducted during *post monsoon* 2017-2018 at Experimental farm, Department of Agronomy, College of Agriculture, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani. The soil was clayey in texture, low in nitrogen, low in phosphorus, rich in potash and slightly alkaline in reaction. The experiment was laid down in Split-plot design with 12 treatment combinations comprising of three dates of sowing i.e. S<sub>1</sub> (MW 38), S<sub>2</sub> (MW 39), S<sub>3</sub> (MW 40) as main plot treatments whereas four varieties i.e. JS-9560 (V<sub>1</sub>), MAUS-612 (V<sub>2</sub>), MAUS-162 (V<sub>3</sub>) and MAUS-71 (V<sub>4</sub>) as subplot treatments. Each treatment was replicated three times.

Sowing was done according to meteorological weeks as per the treatments by dibbling two seeds per hill at a recommended spacing of 45 cm × 05 cm by keeping seed rate 65 kg ha<sup>-1</sup>. Fertilizer (30:60:30 Kg. N:P:K per ha.) viz., nitrogen, phosphorus and potassium were applied to respective plots as per the recommendations by using the urea, DAP and MoP uniformly in the lines opened for sowing as per the treatment.

Five plants from each net plot were randomly selected and labeled for taking biometric observations at different growth stages. The same plants were harvested separately for post harvest studies. The plants from each net plot were threshed and seeds were cleaned. The cleaned seeds obtained from each net plot were weighted in kg. After separation of seeds from biological yield, remaining material (stem + pod husk) was considered as straw yield and its final weights were recorded in kg per net plot, which were then converted into straw yield (Kg ha<sup>-1</sup>) by multiplying hectare factor.

## Results and Discussion

The data regarding growth parameters including AGR & RGR is presented in Table 1 whereas yield components are in Table 2.

### Effect of date of sowing

The data on growth indices like AGR as depicted in Figure 1 and 2 (plant height and dry matter) and RGR (Fig. 3) was highest during 31 to 45 DAS and declined later on. This indicates that's the grand growth period of crop was between 31-45 DAS. AGR (plant height and dry matter) and RGR were higher with date of sowing S<sub>1</sub> (MW 38) at all the stages growth and last sowing date S<sub>3</sub> (MW 40) recorded lowest values AGR and RGR.

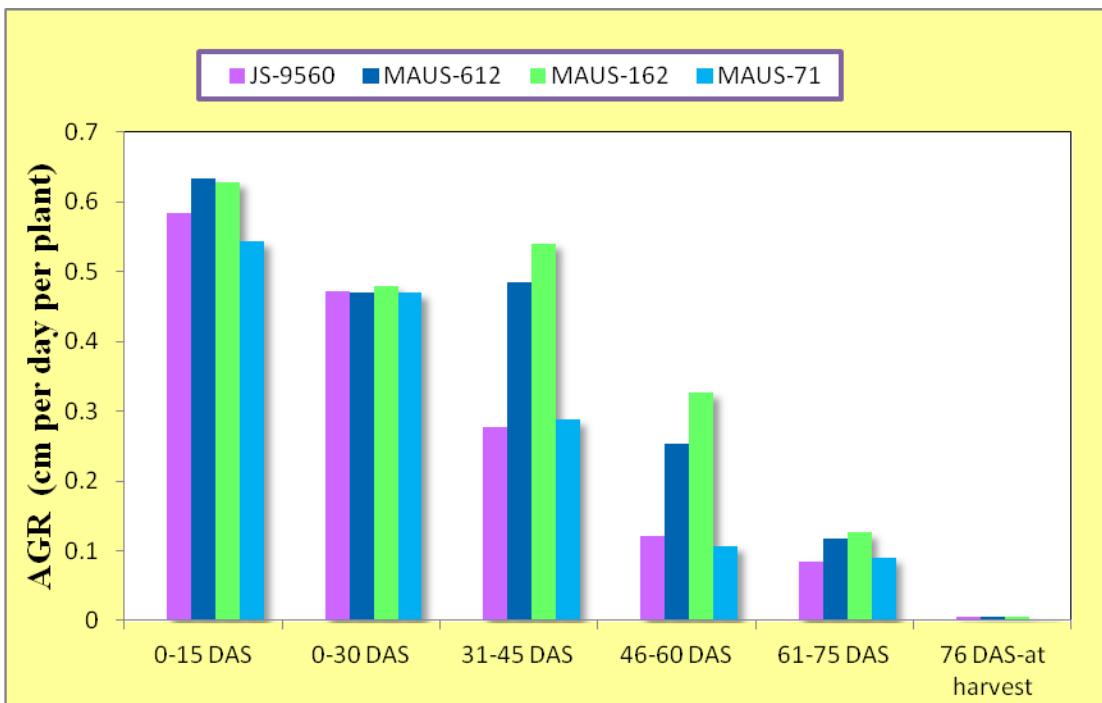
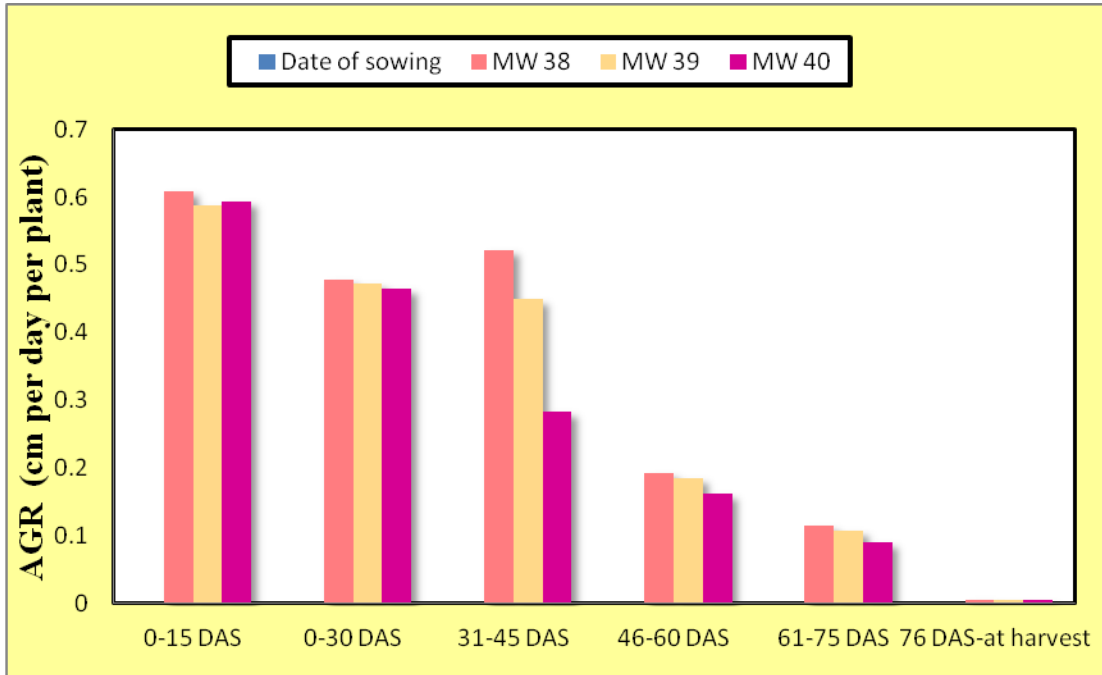
**Table.1** Mean absolute growth rate for plant height (cm day<sup>-1</sup> plant<sup>-1</sup>), absolute growth rate for dry matter (g day<sup>-1</sup> plant<sup>-1</sup>) and mean Relative Growth Rate (g g<sup>-1</sup> day<sup>-1</sup> plant<sup>-1</sup>) for dry matter as influenced by different treatments at various growth stages of soybean crop

Treatment	AGR (cm day <sup>-1</sup> plant <sup>-1</sup> )						AGR (g day <sup>-1</sup> plant <sup>-1</sup> )						RGR (g g <sup>-1</sup> day <sup>-1</sup> plant <sup>-1</sup> )					
	0-15 DAS	15-30 DAS	31-45 DAS	46-60 DAS	61-75 DAS	75-harvest	0-15 DAS	15-30 DAS	31-45 DAS	46-60 DAS	61-75 DAS	75-at harvest	0-15 DAS	15-30 DAS	31-45 DAS	46-60 DAS	61-75 DAS	75-at harvest
<b>Date of sowing</b>																		
S <sub>1</sub> –MW 38	0.610	0.479	0.523	0.193	0.115	0.006	0.078	0.085	0.207	0.229	0.085	0.010	0.010	0.049	0.055	0.032	0.009	0.001
S <sub>2</sub> –MW 39	0.589	0.463	0.450	0.186	0.108	0.005	0.078	0.069	0.145	0.183	0.093	0.007	0.010	0.042	0.046	0.032	0.012	0.001
S <sub>3</sub> –MW 40	0.595	0.476	0.284	0.163	0.091	0.005	0.075	0.061	0.116	0.148	0.049	0.009	0.008	0.040	0.041	0.031	0.008	0.001
<b>Varieties</b>																		
V <sub>1</sub> – JS-9560	0.585	0.473	0.277	0.122	0.085	0.005	0.080	0.076	0.156	0.199	0.098	0.009	0.012	0.045	0.046	0.033	0.012	0.001
V <sub>2</sub> – MAUS-612	0.634	0.471	0.485	0.253	0.118	0.006	0.079	0.073	0.180	0.203	0.099	0.009	0.011	0.044	0.052	0.032	0.011	0.001
V <sub>3</sub> – MAUS-162	0.629	0.479	0.541	0.327	0.126	0.006	0.075	0.067	0.143	0.175	0.054	0.011	0.008	0.043	0.047	0.032	0.007	0.001
V <sub>4</sub> – MAUS-71	0.544	0.470	0.288	0.107	0.090	0.004	0.075	0.070	0.147	0.168	0.051	0.007	0.008	0.044	0.047	0.030	0.007	0.001
<b>General mean</b>	<b>0.598</b>	<b>0.473</b>	<b>0.415</b>	<b>0.185</b>	<b>0.105</b>	<b>0.005</b>	<b>0.077</b>	<b>0.072</b>	<b>0.156</b>	<b>0.186</b>	<b>0.076</b>	<b>0.009</b>	<b>0.010</b>	<b>0.045</b>	<b>0.046</b>	<b>0.033</b>	<b>0.012</b>	<b>0.001</b>

**Table.2** Mean seed yield, straw yield, biological yield (kg ha<sup>-1</sup>) and harvest index (%) of soybean as influenced by different treatments

Treatment	Seed Yield (kg ha <sup>-1</sup> )	Straw Yield (kg ha <sup>-1</sup> )	Biological yield (kg ha <sup>-1</sup> )	Harvest index (%)
<b>Date of sowing</b>				
S <sub>1</sub> –MW 38	1465.79	2489.09	3964.88	36.96
S <sub>2</sub> –MW 39	1027.71	2071.11	3098.82	33.16
S <sub>3</sub> –MW 40	586.97	1771.13	2358.10	24.89
SE ±	26.69	39.96	73.27	--
CD at 5 %	104.79	156.86	287.64	--
<b>Varieties</b>				
V <sub>1</sub> – JS-9560	1269.95	2109.06	3390.12	37.46
V <sub>2</sub> – MAUS-612	1204.26	2257.91	3464.39	34.76
V <sub>3</sub> – MAUS-162	844.60	2033.72	2878.32	29.34
V <sub>4</sub> – MAUS-71	788.49	2041.07	2829.56	27.86
SE ±	27.72	20.65	35.00	--
C.D. at 5 %	82.35	61.34	103.99	--
<b>Interaction (SxV)</b>				
SE ±	48.01	35.76	60.62	--
C.D. at 5 %	142.64	106.25	180.11	--
<b>General mean</b>	<b>1026.82</b>	<b>2110.44</b>	<b>3140.60</b>	<b>32.89</b>

**Fig.1** AGR by plant height (cm day<sup>-1</sup> plant<sup>-1</sup>) of soybean influenced periodically by different date of sowing and varieties



**Fig.2** AGR by dry matter ( $\text{g day}^{-1} \text{plant}^{-1}$ ) of soybean influenced periodically by different date of sowing and varieties

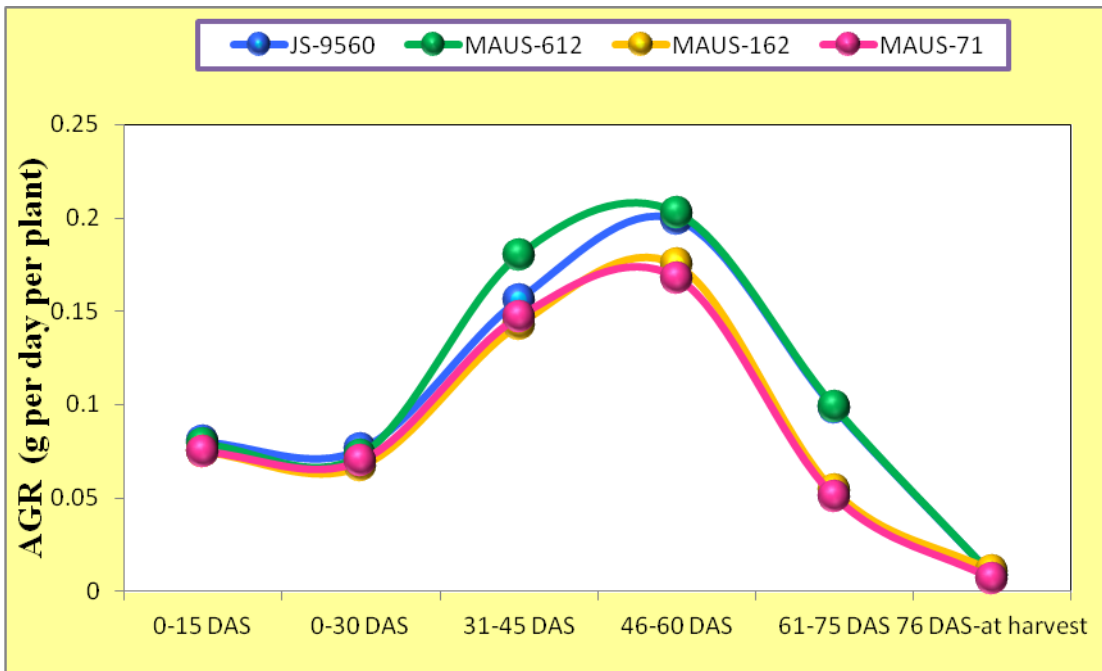
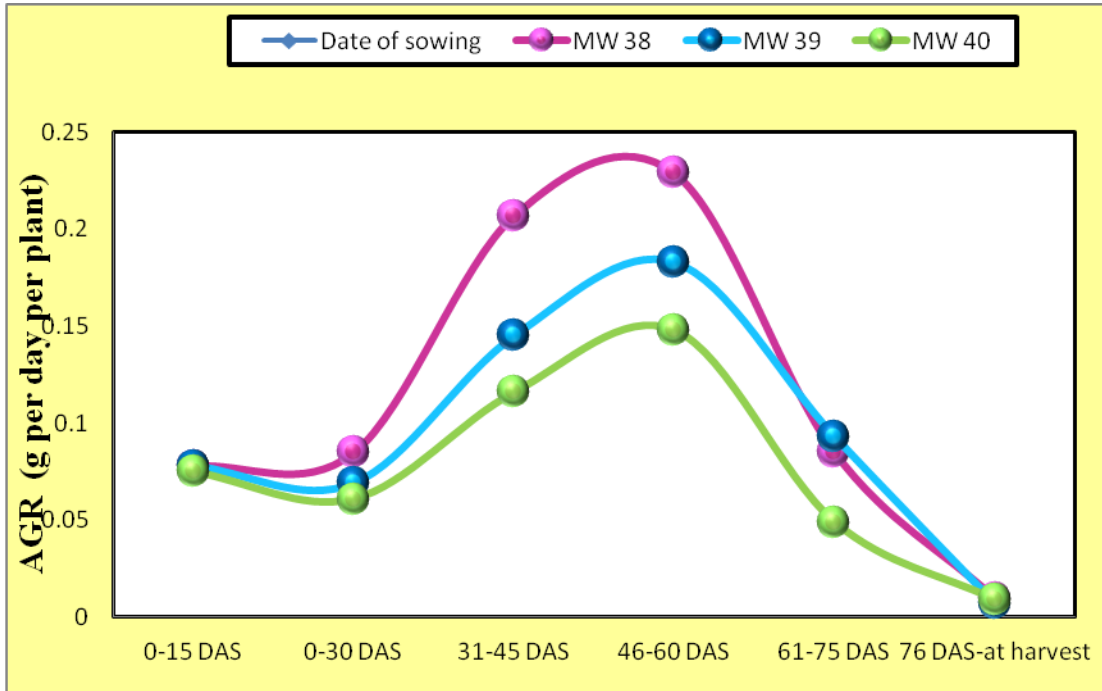
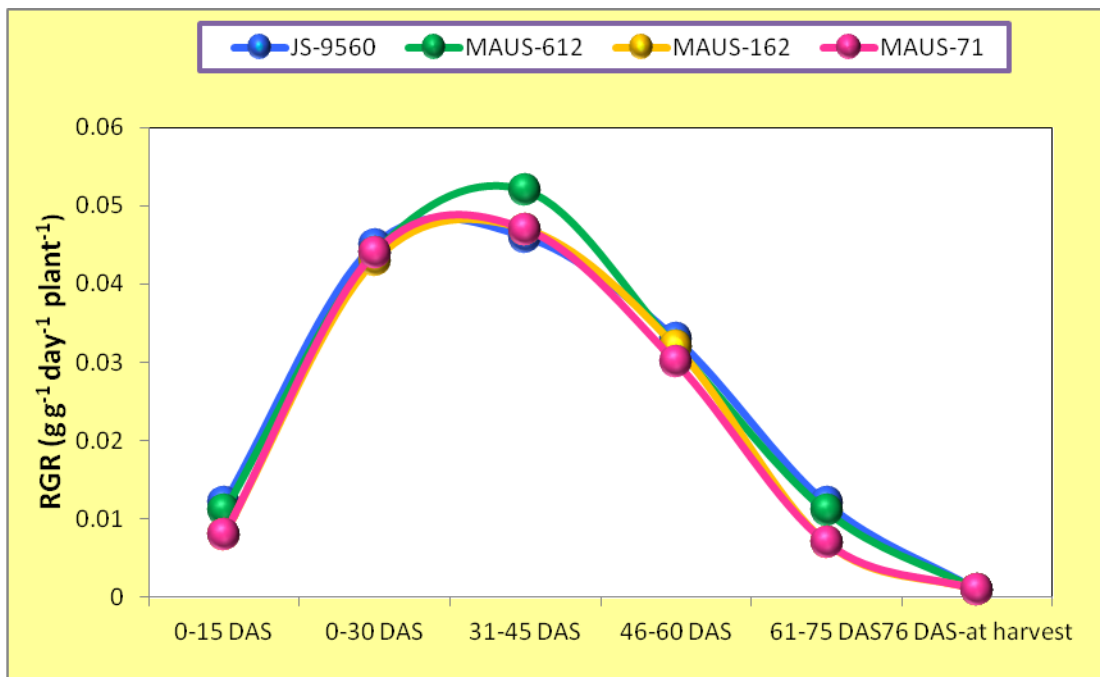
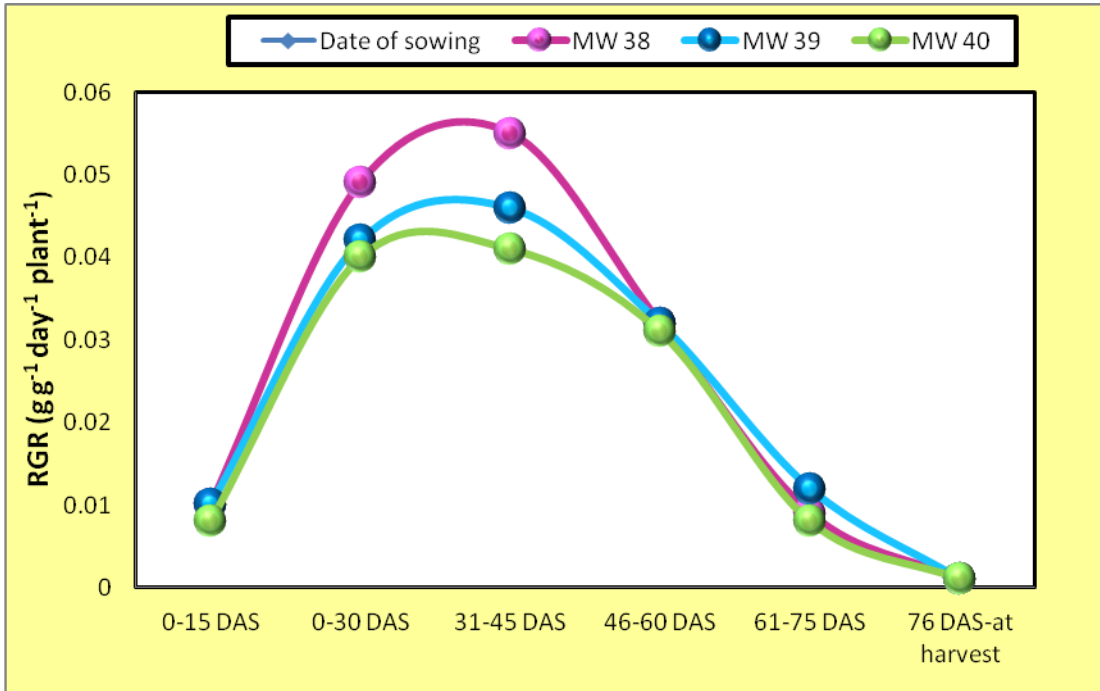


Fig.3 RGR ( $\text{g g}^{-1} \text{day}^{-1} \text{plant}^{-1}$ ) of soybean as influenced periodically by different date of sowing and varieties



Similar reduction in AGR and RGR with delayed sowing of soybean was found by Aastha *et al.*, (2017). Seed yield is a function of various yield attributes. Similarly, biological yield of crop plant has a close relationship with its economical yield. The dates of sowing S<sub>1</sub> (MW 38) recorded highest seed yield ha<sup>-1</sup> and was significantly superior to the rest of sowing dates. This might be due to longer duration of vegetative and reproductive stages from earlier sown soybean.

The difference in the seed yield was 59.95 % among the dates of sowing. The lowest seed yield and biological yield ha<sup>-1</sup> has recorded by the dates of sowing S<sub>3</sub> (MW 40). This might be due to delayed sowing generally shifts reproductive growth into less favorable conditions with shorted days, lower radiation and temperature. Similar reduction in yield due to late sowing of soybean was reported by Nath *et al.*, (2017).

Straw yield was an augmenting effect of increased vegetative growth through plant height, number of branches and number of leaves plant<sup>-1</sup>. Profound effect on straw yield ha<sup>-1</sup> was noted due to different dates of sowing. The dates of sowing S<sub>1</sub> (MW 38) produced highest straw yield which significantly superior over the rest of sowing dates. The difference in the straw yield was 11.47 % in among the first and last dates of sowing. This may be due to more number of leaves, highest plant height and maximum dry matter accumulation as a result of this highest straw yield.

Early sowing dates favoured seed, pod and biological yield due to congenial weather parameters for better and balanced vegetative growth and proper portioning of dry matter in reproductive parts which is reflected through higher values of harvest index at S<sub>1</sub> (MW 38) sowing date. Anil kumar *et al.*, (2008) and Hari Ram *et al.*, (2010)

### **Effect of varieties**

The data on growth indices like AGR (plant height) and RGR was highest during 31 to 45 DAS and declined later on. AGR (dry matter) was higher at 45-60 and decreased thereafter. This indicates that's the grand growth period of crop was between 31-60 DAS. The V<sub>3</sub> (MAUS- 162) recorded numerically maximum AGR (cm day<sup>-1</sup> plant<sup>-1</sup>) at all the stages of crop growth than rest of the varieties except at 0-15 DAS. V<sub>1</sub> (JS- 9560) recorded higher AGR (g day<sup>-1</sup> plant<sup>-1</sup>) at 0-30 DAS. Whereas, during 31 DAS, V<sub>2</sub> (MAUS- 612) recorded highest AGR (g day<sup>-1</sup> plant<sup>-1</sup>) than rest of the varieties. V<sub>1</sub> (JS- 9560) recorded higher RGR at all the stages of crop growth except during 31-45 DAS than rest of the varieties. Whereas, during 31-45 DAS, V<sub>2</sub> (MAUS- 612) recorded higher RGR values than rest of the varieties. The variety V<sub>1</sub> (JS- 9560) recorded highest seed yield which was superior over the V<sub>3</sub> (MAUS-162) and V<sub>4</sub> (MAUS-71) but at par with V<sub>2</sub> (MAUS-612). These results collaborate to those reported by and Meena *et al.*, (2013).

Straw yield (kg ha<sup>-1</sup>) an augmenting effect of increased vegetative growth through plant height, number of branches and number of leaves plant<sup>-1</sup> of the variety. Profound effect on straw yield (kg ha<sup>-1</sup>) and biological yield (kg ha<sup>-1</sup>) was noted due to different varieties. V<sub>2</sub> (MAUS-612) produced higher straw yield and biological yield than V<sub>3</sub> (MAUS-162) and V<sub>4</sub> (MAUS-71) and it was at par with V<sub>1</sub> (JS- 9560). This may be due to profuse branching, more number of leaves, plant height and maximum dry matter as result of this higher straw yield.

### **Interaction effect**

The interaction effect between date of sowing and varieties was found to be significant in influencing the yield attributing characters,



seed yield, straw yield and biological yield. The sowing of soybean with date of sowing in S<sub>1</sub> (MW 38) with Variety JS- 9560 i.e. (S<sub>1</sub>V<sub>1</sub>) recorded significantly higher number of pods, soybean seed yield, harvest index which was at par with date of sowing in S<sub>1</sub> (MW 38) with Variety MAUS-612 i.e. (S<sub>1</sub>V<sub>2</sub>) than rest of the treatment combinations, this might be due to favourable weather conditions and superior varietal characters.

In conclusion, after considering the results of experiment, the following conclusions can be drawn from the present investigation that, during *post-monsoon* season, early sowing of soybean on 38<sup>th</sup> MW (S<sub>1</sub>) results in higher growth and yield as compared to late sowing on MW 39<sup>th</sup> and 40<sup>th</sup> MW. Under varied weather conditions during *post-monsoon*, variety JS-9560 and MAUS-612 performed better growth, yield and monetary returns than MAUS-162 and MAUS-71. From this study, the varieties JS-9560 and MAUS-612 are best suited for early sowing i.e. on 38<sup>th</sup> MW to obtain higher seed yield during *post-monsoon*.

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