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Original Research Article

Influence of Sowing Time and Varieties on Productivity of Soybean during Rabi Season

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A B S T R A C T

A field experiment was conducted during *rabi*, 2015-16 at Agricultural College Farm, Tirupati to study the effects of varied times of sowing and varieties on the productivity of soybean during *rabi* season. The experiment was conducted using four times of sowings and four different varieties. The present study concludes that Variety JS-335 recorded the highest seed yield while Sowing on second fortnight of September created ideal weather for crop growth and development resulting in higher pod and haulm yields of soybean. The highest pod yield of 1417 kg ha^{-1} was recorded with sowings on second fortnight of September.

Introduction

Soybean belongs to the family Fabaceae sub family Faboideae. It is one of the major oilseed crops of the world. Among the legume crops soybean contains the highest amount of protein (40%) and oil (20%) and a good amount of other nutrients like calcium, phosphorous, iron and vitamins with about 40 % proteins. It contains relatively higher levels of lysine and hence can be used to supplement cereal based diets. Soybean meal obtained after extraction of oil is exported to foreign countries and is a good foreign exchange earner for India. In India, it is known as bhat, bhatmer and rumkut.

Soybean accounts for 54 per cent of global oilseed production. Globally soybean is grown in an area of 109 M.ha with a production of 268.7 million tonnes with average productivity of 2.46 t ha. (FAO, 2015). India ranks fifth in the world in area and production of soybean after United States of America, Brazil, Argentina and China. In the recent past, soybean cultivation has increased manifold as compared to any other oilseed crop in India and stands next only to groundnut, though commercial production of soybean began only from 1971-72. In India it occupied an area of 11 M.ha with seed yield of about 1000 kg ha^{-1} (SOPA, 2015). Substantial outputs of edible oilseeds were attained during early nineties due to yellow revolution in India, yet the country has not achieved self-sufficiency in oil scenario owing to burgeoning population. To meet ever increasing demand for edible oils and pulses in India, soybean, a dual purpose crop, can bridge the increasing gap between

the demand and supply and can improve the per capita consumption of the same in the country. Such compulsion emphasized the need for its expansion in non-traditional areas like Andhra Pradesh.

The productivity is low due to various constriants. The time of sowing has a considerable influence on growth and yield of soybean. Early sowing in the season may encourage higher vegetative growth which may invite various pests and diseases. However delayed sowing may shrink the vegetative phase, which in turn reduces the drymatter accumulation leading to poor partitioning to reproductive parts and ultimately poor realization of the potential yield of this crop. The varieties are equally important for realization of the potential yield of this crop. Keeping the above facts in view, the present investigation entitled "Influence of sowing time and varieties on productivity of soybean during *rabi* season was therefore conducted.

Materials and Methods

A field experiment was laid out in field No. 94 of dry land block on sandy loam soil (Alfisols) during *rabi* season at Tirupati. The experimental soil was neutral in reaction (7.5), low in organic carbon (0.43 %) and available nitrogen (213 kg ha^{-1}), medium in available phosphorous (24 kg ha^{-1}) and available potassium (254 kg ha^{-1}). During the crop growth period, total amount of 1147.1 mm of rainfall was received in 35 rainy days. The weekly mean maximum temperature during the crop growth period ranged from 26.2^0 to 33.9^0 C while the weekly mean minimum temperature ranged from 14.8^0 to 23.1^0 C. The evaporation rate (USWB Class-A open pan evaporimeter) ranged from 3.0 to 5.0 mm day^{-1}, with an average of 4.0 mm day^{-1}. The experiment comprised of sowing times (second fortnight of September, second fortnight of October, second fortnight of October and first fortnight of November) and four cultivars (Basar, JS-93-05, Bheem, JS-335). The experiment was laid out in randomized block design with factorial concept consisting of sixteen treatments replicated three times.

At maturity, all the above ground soybean phytomass from each net area was harvested and transported to the threshing floor. After sundrying, for seven days, the phytomass from each plot was weighed before subjecting it for threshing. After threshing, weight of the seeds was recorded plot-wise and expressed in kg ha^{-1}.

The plants in the net plot area after removal of the pods from haulms were sun dried thoroughly till constant weight was attained and haulm yield was recorded and expressed in kg ha^{-1}.

Results and Discussion

Analysis of the data revealed that the yield was significantly affected by various sowing times and varieties.

Seed Yield

Regarding times of sowing, crop sown during second fortnight of September (D_1) recorded highest seed yield (1417.3 kg ha^{-1}), which was comparable that due to first fortnight of October (D_2). Lowest seed yield (787.5 kg ha^{-1}) was with latest sown crop (1st fortnight of November).

Higher seed yield of soybean with early sowings was due to ideal weather for crop growth and development leading to improvement in seed yield due to timely seeding has been reported in several crops, including soybean.

Ram *et al.,* (2010) also expressed similar views that higher seed yield with the early sown crop due to more congenial growth conditions during the crop period and sufficient time to complete all physiological processes properly than late sown crop.

The yield reduction with delayed sowings may be the cumulative effect of lower values of growth parameters recorded at all the stages of crop growth. Besides, the reduction in yield with delayed sowing times can also be attributed to unfavorable weather conditions *viz.*, temperature with low light interception experienced by the crop.

Variety JS- 335 (V_4), which was on par with Basar (V_1) recorded highest soybean yield (1204.9 kg ha). Difference in yield due to Basar (V_1) and Bheem (V_3) and also between Bheem (V_3) and JS-335 (V_2) were also not significant. Improvement in yield attributes have contributed to higher yield with JS-335 (V_2) and in other words, yield potential of JS-335 (V_2) is higher than that of the other three varieties tested. These results confirmed by the findings of Halvankar *et al.,* (1999).

Interaction of times of sowing and varieties had no significant influence of seed yield of soybean.

Haulm Yield

Haulm yield differed significantly due to times of sowing and varieties (Table 1). Each successive delay in sowing from second fortnight of September (D_1) to first fortnight of November (D_4) significantly decreased the haulm yield of soybean. Timely sowings resulted in highest haulm yield with early sowings (second fortnight of September and first fortnight of October). These results are in conformity with those reported by Ram *et al.,* (2010).

Variety JS-335 (V_4) recorded significantly higher haulm yield (2208 kg ha^{-1}) followed by Basar (V_1) compared with Bheem (V_3) and JS-93-05 (V_2). The differences between any two times of sowing and varieties are significant.

Higher haulm yield with JS-335 (V_4) and Basar (V_1) relative to Bheem (V_3) and JS-93-05 (V_2) can be attributed to improvement in growth parameters with two varieties JS-335 and Basar. Ram *et al.,* (2010) recorded better haulm yield in SL-790 than in SL-744 and SL-525 soybean varieties.

Harvest Index

Harvest index differed significantly due to times of sowing and varieties (Table 1). Early sowings (second fortnight of September and first fortnight of October) which were at par (30.8 and 29.9 %), recorded significantly highest harvest index compared with the later sowings (second fortnight of October and first fortnight of November). Latest sown crop first fortnight of November) recorded lower harvest index (23.3 %) compared to the crop sown on second fortnight of October (26.5 %).

Relatively higher harvest index with early sowings can be attributed to good crop growth with early sown crop. Adequate soil moisture availability due to high rainfall and relatively longer sunshine hours might have contributed to improvement in growth parameters leading to higher harvest index with early sowings. Ram *et al.,* (2010) reported that timely planting of soybean recorded higher harvest index than the late sown crop.

Variety JS-335 (V_4) recorded highest harvest index of 29.7 % which was on par with that due to Basar (V_1) which recorded harvest index of 28.2 %. JS-93-05 (V_2)

recorded lowest harvest index of 25.8 %, which was on par with that due to Bheem (V_3). Difference between Bheem (V_3) and Basar (V_1) was also not significant.

Higher harvest index with JS-335 (V_4) and Basar (V_1) can be attributed to improvement in growth parameters with these two varieties compared with Bheem (V_3) and JS-93-05 (V_2). Favorable weather in terms of rainfall, bright sunshine hours might have contributed to improvement in growth and development leading to higher harvest index with JS-335 (V_4) and Basar (V_1). Ram *et al.*, (2010) and (Sharma and Sharma, 1993) also reported similar varietal differences with regard to harvest index in soybean.

Harvest index didnot differ significantly due to the interaction of times of seeding and varieties.

From the results, it is evident that sowing on second fortnight of september and JS-335 variety are effective for higher productivity of soybean grown during *rabi* season.

Table.1 Seed yield (kg ha^{-1}), haulm yield (kg ha^{-1}) and harvest index of soybean as influenced by times of sowing and varieties

Treatments	Seed Yield (kg ha^{-1})	Haulm Yield (kg ha^{-1})	Harvest Index
Times of sowing			
D_1: Second fortnight of September	1417.3	2399.1	30.8
D_2: first fortnight of October	1319.4	2158.0	29.9
D_3: Second fortnight of October	840.6	1680.4	26.5
D_4: first fortnight of November	787.5	1501.9	23.3
SEm±	44.2	38.2	0.9
CD (P=0.05)	128.3	110.7	2.7
Varieties			
V_1: Basar	1158.9	2077.7	28.2
V_2: JS-93-05	942.2	1632.4	25.8
V_3: Bheem	1058.7	1821.8	26.8
V_4: JS-335	1204.9	2207.6	29.7
SEm±	44.2	38.2	0.9
CD (P=0.05)	128.3	110.7	2.7
Interaction			
SEm±	88.4	76.3	1.8
CD (P=0.05)	NS	NS	NS

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SOPA: Soybean Processing Association, Indore.