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Response of Soybean Varieties to different Threshing Methods and Storage Periods

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ABSTRACT: *To study the impact of seed damage and yield potential of soybean under different threshing methods and varieties the field investigation on was carried out in* kharif *season, 2013 at Department of Agronomy, Mahatma Phule Krishi Vidyapeeth, Rahuri. The experiment was laid out in split plot design with three replications comprised of three varieties* viz., *JS-335, JS-93-05 and JS-95-60 threshed by three methods* viz., *stick beaten, threshing with multicrop thresher and threshing with combine harvester.The variety JS-335 exhibited significantly higher growth contributing characters* viz., *plant height (52.53 cm), number of branches plant^{-1} (5.50) and number of nodules plant^{-1} (39.12) as compared to variety JS-93-05 and JS-95-60 at harvest. The yield attributes* viz., *number of pods plant^{-1} (79.99), weight of pods plant^{-1} (31.81 g), number of seeds per plant^{-1}(238.02), weight of seeds plant^{-1} (19.55 g) and test weight (15.36 g) as well as yield of soybean was significantly higher (23.47 q ha^{-1}) with variety JS-335 followed by variety JS-93-05 (17.88 q ha^{-1}). The stick beaten threshing method exhibited significantly higher growth contributing characters* viz., *plant height (50.93 cm), number of branches plant^{-1} (5.24) and number of nodules plant^{-1} (40.50) as compared to variety JS-93-05 and JS-95-60 at harvest. The yield attributes* viz., *number of pods plant^{-1} (63.73), weight of pods plant^{-1} (28.23 g), number of seeds per plant^{-1} (194.72), weight of seeds plant^{-1} (18.39 g) and test weight (14.10 g) as well as yield of soybean was significantly higher (20.46 q ha^{-1}) with stick beaten threshing method followed by threshing with multicrop thresher threshing method (18.13 q ha^{-1}) .The variety JS-335 threshed with stick beaten method recorded significantly maximum plant height (53.43 cm), number of branches plant^{-1} (5.63) number of pods plant^{-1} (83.87), weight of pods plant^{-1} (34.41 g), number of seeds per plant^{-1} (247.83), weight of seeds plant^{-1} (22.03 g) as well as yield of soybean (26.41 q ha^{-1}).The highest gross monetary returns (Rs.121998 ha^{-1}) and net monetary returns (Rs. 83100 ha^{-1}) was obtained with variety JS-335 threshed with stick beaten method.*

Key words: *Soybean, Varieties, Threshing methods, Storage*

Soybean [*Glycine max* (L)*Merill*] is an important legume crop belonging to the family Leguiminosae, sub family Papilionaceae and genus Glycine. Soybean has become a miracle crop of the twentieth century and is often designated as 'Golden bean'. It is a triple beneficiary crop, a unique food, a valuable feed and an industrial raw material with considerable potential. Soybean crop having wide variation in yield attributes, seed yield, nutritional value and seed quality. The differences in soybean cultivars might be due to the genetic makeup factors. Soybean crop, as all cereal crops, begins to lose quality when they are harvested, processed or stored. The losses of seed viability resultant destitution in plant stand which is the basis for appropriate production and expansion of this crop mainly in tropical and subtropical countries. Soybean seed deteriorates faster than those of most other crops. Mechanical threshing causes more damage to the seed compared to manual threshing. Threshing by hand method recorded higher laboratory germination percentage, least physical damage and electrical conductivityin soybean seed compared to beating on cement floor. Jha *et al*. (1995) threshed soybean seed by hand beating, machine threshing, or tractor treading and kept under ambient storage conditions and then tested for seed quality. They found that hand beating resulted in higher germination levels and less deterioration of seed than the other two techniques at all stages of storage. In view of above, the present research is undertaken to study "Response of soybean varieties to different threshing methods and storage periods" during the *kharif* season of 2013.

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MATERIAL AND METHODS

Research was carried out at Post Graduate Institute Research Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri Research field is situated on 19°24' N latitude and 76° 19' E longitude. The altitude varies from 495 to 555 m above the mean sea level. Climatologically, the area falls under semi-arid and sub tropical zone. The experiment consists of nine treatment combinations. The main plot treatments consist of three varieties and subplot treatments consist of three threshing methods. These treatments were replicated thrice times in a split plot design. The soil of experimental field was well drained. The soil depth varies from 30-45 cm. The soil physical properties such as, field capacity, permanent wilting point and bulk density was 36.84 per cent, 18.17 per cent and 1.29 g cm^{-3}, respectively. The soil was low in available nitrogen (147.80 kg ha^{-1}), low inavailable phosphorus (9.60 kg ha^{-1}) and very high in available potassium (436.80 kg ha^{-1}) with alkaline in reaction (pH 8.1). The electrical conductivity of soil was 0.62 dSm^{-1} at 25°C and initial organic carbon content was 0.57 per cent.The land was prepared by one ploughing and two harrowing. The full dose of major plant nutrients was applied as basal application through, single super phosphate and muriate of potash, while the nitrogen through urea given in two splits, 50% as basal application and remaining 50% at 30 days after sowing. The threshed seeds from different methods *viz,* stick beaten, multicrop thresher and combine harvester of three varieties viz, JS-335, JS-93-05 and JS-95-60 were collected from F block Seed Cell Unit, MPKV, Rahuri during the *kharif* season of 2012. The seed production programme of above three varieties has taken in large area in isolation. Then in that plot we have harvested and threshed that seed by using three threshing methods. From these seed production programme and the same seed source, were used for sowing. Sowing of seed was done manually by dibbling using a seed rate of 75 kg ha^{-1} and spacing at 30 cm X 10 cm with depth of 3-4 cm. During experimental period three irrigations were given uniformly to all the plots, because of large dry spell coinciding the pre flowering stage of crop. The crop was harvested when the foliage of the soybean plants turned yellowish brown to brown in colour and started to fall down. To record the various growth observations, five plants were selected at random in each net plot, which were marked with wooden pegs and tied with tags for easy identification.After harvest of soybean crop, seed and straw yield were recorded. To determine oil and protein content, grains of each variety was taken into 'soybean cup' which is used to feed these grains to the instrument called NIR SPECTRA ANALYSER (Near Infra-Red Region). Four replications each of 100 seeds from respective treatments were used for germination by using between paper methods (BP). The seed was germinated at 25 ± 2 ^{0}C in germinator for 8 days. The germination per cent was recorded on the basis of normal seedlings. Economics of treatments was also computed taking into account the prevailing market prices for inputs and outputs.

Table 1
Physico-chemical properties of experimental field

Soil Characteristics	*Texture*	*pH*	*EC (dSm^{-1})*	*OC(%)*	*Bulk Density ($g\ cm^{-3}$)*	*Available nutrients*		
						N ($kg\ ha^{-1}$)	*P ($kg\ ha^{-1}$)*	*K ($kg\ ha^{-1}$)*
Composition	Sandy Clay Loam	8.1	0.62	0.57	1.29	147.8	9.6	436.8

RESULTS AND DISCUSSION

Growth, Yield and Economics

Growth parameters (plant height, number of branches $plant^{-1}$, Number of nodules $plant^{-1}$, Number of pods $plant^{-1}$, Weight of pods $plant^{-1}$, Weight of seeds $plant^{-1}$ and test weight), seed yield and straw yields of soybean were significantly higher under variety JS-335 as compared to variety JS-93-05 and JS-95-60 (Table 2).The highest plant height (52.53 cm), number of branches $plant^{-1}$ (5.50), number of nodules $plant^{-1}$ (39.12), number of pods $plant^{-1}$ (79.99), weight of pods $plant^{-1}$ (31.81 g), number of seeds per $plant^{-1}$(238.02), weight of seeds $plant^{-1}$ (19.55 g) and test weight (15.36 g) as well as yield of soybean (23.47 q ha^{-1}) with variety JS-335 followed by variety JS-93-05(17.88 q ha^{-1}). This might be due to the genetical characters of variety JS-335.These results are in close conformity with the findings of Rasaily *et al.* (1986).

Plant height, number of branches $plant^{-1}$, Number of nodules $plant^{-1}$, Number of pods $plant^{-1}$, Weight of pods $plant^{-1}$, Weight of seeds $plant^{-1}$, test weight, seed yield and straw yields of soybean were influenced significantly due to different threshing methods.

Table 2
Growth parameters and yield of soybean as affected by varieties and threshing methods

Treatment	*Plant height (cm)*	*No. of branches plant^{-1}*	*No. of root nodules plant^{-1}*	*No. of pods plant^{-1}*	*Wt of pods plant^{-1} (g)*	*No. of seeds plant^{-1}*	*Wt of seeds plant^{-1} (g)*	*Test wt (g)*	*Grain yield (q ha^{-1})*	*Straw yield (q ha^{-1})*
A. Main Factor-Varieties										
V_1	52.53	5.50	39.12	79.99	31.81	238.02	19.55	15.36	23.47	28.16
V_2	49.98	5.13	37.67	62.46	28.09	196.87	16.22	11.95	17.88	21.45
V_3	46.92	4.59	37.36	39.55	18.78	120.69	13.11	14.47	13.79	16.55
CD at 5%	0.79	0.27	0.63	1.83	0.62	6.83	1.14	0.69	1.64	1.97
B. Sub Factor-Threshing methods										
T_1	50.93	5.24	40.50	63.73	28.23	194.72	18.39	14.10	20.46	24.55
T_2	49.66	5.17	37.94	60.38	26.49	185.66	16.00	13.98	18.13	21.76
T_3	48.84	4.81	35.70	57.89	23.96	175.20	14.49	13.71	16.54	19.85
CD at 5%	0.52	0.16	0.53	1.30	0.57	3.74	0.68	NS	0.72	0.78
Interaction										
1. Between two subplots means at same level of main plot mean										
CD at 5%	0.91	0.33	0.92	2.25	0.96	6.48	1.18	1.19	1.20	1.32
2. Between two main plots means at same level of sub plot mean										
CD at 5%	1.08	0.33	0.97	2.58	0.99	8.57	1.48	1.19	1.92	2.23

V_1-JS-335, V_2- JS-93-05, V_3- JS-95-60,
T_1-Stick beaten, T_2-Threshing with multicrop thresher and T_3-Threshing with combine harvester

The stick beaten threshing method exhibited significantly higher plant height (50.93 cm), number of branches plant^{-1} (5.24), number of nodules plant^{-1} (40.50), number of pods plant^{-1} (63.73), weight of pods plant^{-1} (28.23 g), number of seeds per plant^{-1} (194.72), weight of seeds plant^{-1} (18.39 g) and test weight (14.10 g) as well as yield of soybean (20.46 q ha^{-1}).

The highest gross monetary returns (Rs. 108426 ha^{-1}), and net monetary returns (Rs.74363 ha^{-1}) were recorded with the variety JS-335. The similar trends was observed in case of B:C ratio (3.19). The stick beaten threshing method recorded the highest gross monetary returns (Rs.94514 ha^{-1}), and net monetary returns (Rs.55612 ha^{-1}). The maximum benefit: cost ratio was obtained with threshing with multicrop thresher threshing method. These results are in accordance with those reported by El-Abady *et.al.* (2012).

The interaction effect of variety JS-335 threshed with stick beaten threshing method recorded highest values of important growth attributes *viz*., at harvest plant height plant $^{-1}$ (53.43), number of branches plant^{-1} (5.63), number of root nodules plant^{-1} (42.47), the number of pods plant^{-1} (83.87), weight of pods plant^{-1} (34.41 g), number of seeds plant^{-1} (247.83), weight of seeds plant^{-1} (22.03 g) and test weight (16.01 g) than the rest of the treatment combinations. The seed yield (26.41 q ha^{-1}) , straw yield (31.69 q ha^{-1}) , the gross monetary returns (Rs. 121998 ha^{-1}) and net monetary returns (Rs. 83100 ha^{-1})was significantly influenced due to interaction between variety JS-335 threshed with stick beaten threshing method.

Table 3
Economics of soybean as affected by varieties and threshing methods

Treatment	*Cost of cultivation (Rs. ha^{-1})*	*Gross monetary (Rs. ha^{-1})*	*Net monetary (Rs. ha^{-1})*	*B:C ratio*
A. Main Factor-Varieties				
V_1	30925	108426.22	74363.72	3.19
V_2	30925	82595.33	48529.83	2.43
V_3	30925	63704.67	29633.67	1.88
CD at 5%	NS	7602.34	7602.34	0.21
B. Sub Factor-Threshing methods				
T_1	46878	94514.39	55612.56	2.43
T_2	34862	83776.00	50881.67	2.55
T_3	29878	76435.33	46033	2.51
CD at 5%	NS	3365.27	3365.27	0.08
Interaction				
1. Between two subplots means at same level of main plot mean				
CD at 5%	NS	5825.65	5825.65	NS
2. Between two main plots means at same level of sub plot mean				
CD at 5%	NS	8901.33	8901.33	NS

V_1-JS-335, V_2-JS-93-05, V_3-JS-95-60, T_1- Stick beaten, T_2- Threshing with multicrop thresher and T_3- Threshing with combine harvester

Germination Studies

Variety JS-93-05 exhibited significantly higher per cent germination (86.33%) at immediately after harvest, 3 months after harvest (81.33%) and at 6 months after harvest (78%), respectively as compared to varieties JS-335 and JS-95-60. This might be due to genetical character of variety JS-93-05. These results are in close conformity with the findings of Rasaily *et al*. (1986).

The stick beaten threshing method registered significantly higher per cent germination (87.33%) at

immediately after harvest, 3 months after harvest (84.00%) and at 6 months after harvest (81.67%), respectively as compared to threshing with multicrop thresher and combine harvester threshing method. These results are in agreement with those of Kuo *et al*. (1989) and Mundhe *et al.* (2005).

Table 4
Germination (%) of soybean as affected by varieties and threshing methods

Treatment	*Germination (%)*		
	Immediately after harvest	*3 months after harvest*	*6 months after harvest*
A. Main Factor-Varieties			
V_1	83.33	80.00	76.67
V_2	86.33	81.33	78.00
V_3	80	77.33	75.33
CD at 5%	0.87	0.75	0.43
B. Sub Factor-Threshing methods			
T_1	87.33	84.00	81.67
T_2	83.67	80.33	77.67
T_3	78.67	74.33	70.67
CD at 5%	1.02	0.48	0.48
Interaction			
1. Between two subplots means at same level of main plot mean			
CD at 5%	NS	0.83	0.83
2. Between two main plots means at same level of sub plot mean			
CD at 5%	NS	1.01	0.80

V_1-JS-335, V_2- JS-93-05, V_3- JS-95-60,
T_1- Stick beaten, T_2- Threshing with multicrop thresher and T_3- Threshing with combine harvester

At 3 and 6 months after harvest variety JS-93-05 threshed with stick beaten method recorded significantly higher per cent germination (86 and 84% at 3 months and 6 months after harvest, respectively). Significantly minimum per cent germination was observed in variety JS-95-60 threshed with combine harvester. These results are in conformity with El Abady *et al*. (2012).

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