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Influence of Different Sowing Dates and Varieties on Seed Quality of Soybean in Coastal Andhra Pradesh

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A field experiment was conducted during early *rabi* season of 2014-15 on clay loam soil at Agricultural College Farm, Bapatla, Andhra Pradesh, to study the influence of sowing dates and varieties on seed quality of soybean in Coastal AP' Early sowing of soybean on 15th September recorded the highest protein content of 34.9 per cent which was on a par with 15th October sowing of soybean and it was significantly superior over 15th November and 15th December sowing. Among the varieties, highest protein content of soybean was recorded with the variety JS-93-05 (35.2 %) which was significantly superior over the other two varieties JS-335 (32.5%) and Local (44.1%). The highest seed quality (Germination %, Seed viability, and seed vigour) of soybean was recorded with soybean sown on 15th September with variety JS-93-05 both at harvest and 30 days after harvest.

Keywords: Soybean, Sowing dates, Varieties, Protein content (%), Germination %, Seed Viability, Seed vigour.

Soybean (*Glycine max L. Merrill)* is a well known oilseed and pulse crop .It is the richest and cheapest source of high quality proteins, minerals, vitamins, and fats. Soybean is called as miracle, "Golden Bean" of 21st century. It is a boon for malnourished world because it is highly nutritive and energy rich monocarpic legume with protein (40 %), oil (20%) and high level of essential amino acid like lysine (5%), minerals (4%), phosholipids (2%) and vitamins viz. thiamine and riboflavin. Quality seed is a major factor in crop development and productivity. Seed quality, as measured by its viability and vigour worldwide, plays a major role in field establishment as well as the final crop yield. Seed deterioration leads to reductions in seed quality, performance and stand establishment (McDonald, 1975). The germination and vigour potential of soybean is short lived as compared to other grain crops and it is often reduced prior to planting time (Nkang and Umoh, 1996). Despite substantial increase in the area under the crop during *kharif* or early *rabi* with potential for high yield, much of the research was confined to *kharif* only. Sowing time of any crop usually determines the seed quality of any variety. Hence, the present investigation was carried out to study the soybean seed quality as influenced by sowing dates and varieties during early *rabi*.

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MATERIALS AND METHODS

A Field experiment was conducted during early *rabi* season of 2014-15 at Agricultural College Farm, Bapatla, Andhra Pradesh, India. The experimental field was clay loam, slightly alkaline in soil reaction (pH 7.2) and EC is (0.26 dsm^{-1}), low in organic carbon (0.48%) and available nitrogen (190 kg ha^{-1}), medium in available phosphorus (22.0 kg ha^{-1}) and high in available potassium (290.5 kg

ha^{-1}). Treatments included four dates of sowing (15th September, 15th October, 15th November and 15th December) as main plots and 3 varieties (JS-335, JS-93-05, Local) in sub plots. "Local" soybean was purchased from local market. NPK was applied as basal 30:60:40 kg ha^{-1} as basal and crop was sown at 45x5 cm. A rainfall of 387.3 mm was received in 15 rainy days during crop growth period. The weekly mean maximum and mean minimum temperatures ranged from 25.5^{0}C to 36.8^{0}C and 15.2^{0}C to 25.7^{0}C, respectively, with an average maximum and minimum temperatures of 31.1^{0}C and 19.9 ^{0}C, respectively. The weekly mean relative humidity ranged from 67.8 to 85.6 percent with an average of 77.0 percent. After harvest and 30 days after harvest the clean seeds of varieties from various sowing dates were tested for determing the germination %, seed viability (%) with Tetrazolium test, seed vigour (%) with Accelerated ageing test and Electrical Conductivity.

RESULTS AND DISCUSSION

Effect of sowing dates

There was significant influence of sowing dates on protein content, and germination %, seed viability (%) with Tetrazolium test and seed vigour (%) with Accelerated agieng at both harvest and 30 days after harvest. But, seed viability (%) with Tetrazolium test was not influenced by sowing dates at harvest.

Early sowing of soybean on 15th September recorded the highest protein content of 34.9 per cent which was on a par with 15th October sowing of soybean but significantly superior over 15th November and 15th December sowing **(Table-1)**. The decrease in protein content with delay in sowing might be due to the reduced span of reproductive phase due to decrease in days to maturity, which might have also affected the fat synthesis of seed and undeveloped seeds of the crop. A positive increase in protein content with early sowings was reported by Agarwal and Vyas (1971).

At harvest and 30 days after harvest the maximum germination of 95.6 % and 87 % respectively, was recorded with early sowing on

Table 1. Protein content of soybean as influenced by sowing dates and varieties

Sowing dates	Varieties			
	JS-93-05	JS-335	Local	Mean
15th September	37.0	35.2	32.4	34.9
15th October	37.6	32.1	31.5	33.7
15th November	31.9	30.3	30.0	30.8
15th December	34.1	32.4	28.0	31.5
Mean	35.2	32.5	30.5	
CD (P=0.05)				
Sowing dates				2.1
Varieties				1.5
Varieties at same date of sowing				NS
dates at the same or different varieties				NS

Table 2. Germination % of soybean at harvest and 30 DAH as affected by sowing date and varieties

Sowing dates	Varieties							
	JS-93-05		JS-335		Local		Mean	
	At harvest	30 DAH	At harvest	30 DAH	At harvest	30 DAH	At harvest	30 DAH
15th September	95.7	90.0	95.3	84.7	95.7	86.3	95.6	87.0
15th October	93.3	85.3	91.3	81.3	92.3	83.0	92.3	83.2
15th November	91.3	82.0	89.3	79.3	90.3	82.0	90.3	81.1
15th December	95.0	85.7	93.3	83.7	93.7	85.0	90.4	84.8
Mean	93.8	85.8	92.3	82.3	93.0	84.1		
CD (P=0.05)								
			At harvest		30 DAH			
Sowing dates			1.5		1.8			
Varieties			NS		1.6			
Varieties at same sowing date			NS		NS			
dates at the same or different varieties			NS		NS			

DAH: Days after harvest

15th September which was significantly superior to all the other dates of sowing **(Table-2)**. The relatively higher germination of the seeds obtained at harvest and also at 30 DAH from early sowing could be that, the early planted crop availed sufficient time for reproductive development, seed filling and maturity than the late sown crop. The results obtained are in conformity with Uem and Unioestc (2003), who reported that seeds from the optimum planting dates had higher percentage of germination than the early or delayed planting crop. In soybean, a late sowing date decreased the germination percentage of resulting seed (Agrawal, 1980).

At harvest, seed viability of soybean with (Tetrazolium test) was not influenced either by the varieties or sowing dates and also by their by interaction. At 30 days after harvest, the highest seed viability of soybean (86.4 %) was recorded with early sowing on 15th September which was significantly superior to the other dates of sowing. However, the seed viability % with tetrazolim test was on a par between 15th October and 15th November sowing. The maximum seed viability recorded in seeds obtained from September 15th sown crop might be due to favorable environment conditions, temperature and moisture content of seed during the storage condition (Table-3).

Table 3. Seed viability (%) with TZ test at harvest and 30 DAH of soybean as influenced by sowing dates and varieties

Sowing dates	Varieties							
	JS-93-05		JS-335		Local		Mean	
	At harvest	30 DAH	At harvest	30 DAH	At harvest	30 DAH	At harvest	30 DAH
15th September	96.0	87.7	95.3	85.3	94.3	86.3	95.2	86.4
15th October	92.7	82.7	90.7	80.7	91.7	82.0	91.7	81.8
15th November	93.0	82.0	91.7	80.0	92.0	80.7	92.2	80.9
15th December	93.7	84.3	92.3	84.3	93.0	83.7	93.0	84.1
Mean	93.8	84.2	92.5	82.6	92.8	83.2		
CD (P=0.05)								
				At harvest		30 DAH		
Sowing dates				NS		2.18		
Varieties				NS		NS		
Varieties at same sowing date				NS		NS		
dates at the same or different varieties				NS		NS		

Table 4. Seed vigour with Accelerated ageing test at harvest and 30 DAH of soybean as influenced by sowing dates andvarieties

Sowing dates	Varieties							
	JS-93-05		JS-335		Local		Mean	
	At harvest	30 DAH	At harvest	30 DAH	At harvest	30 DAH	At harvest	30 DAH
15th September	87.3	84.3	86.0	79.3	86.7	80.0	86.7	81.2
15th October	85.7	78.7	82.0	75.0	85.0	76.7	84.2	76.8
15th November	83.3	78.3	81.3	74.3	82.3	76.7	82.3	76.4
15th December	84.0	79.7	82.3	77.3	83.0	79.7	83.1	78.9
Mean	85.1	80.3	82.9	76.5	84.3	78.3		
CD (P=0.05)								
				At harvest		30 DAH		
Sowing dates				2.6		1.8		
Varieties				NS		1.4		
Varieties at same date of sowing				NS		NS		
dates at the same or different varieties				NS		NS		

Table 5. Seed vigour with EC test at harvest and 30 DAH of soybean influenced by sowing dates and varieties

Sowing dates	Varieties							
	JS-93-05		JS-335		Local		Mean	
	At harvest	30 DAH	At harvest	30 DAH	At harvest	30 DAH	At harvest	30 DAH
15th September	0.46	1.60	0.79	2.07	0.72	1.77	0.66	1.81
15th October	0.61	1.80	0.90	2.17	0.73	2.00	0.74	1.99
15th November	0.82	2.03	0.98	2.43	0.90	2.13	0.90	2.20
15th December	0.72	1.87	0.95	2.40	0.75	2.03	0.81	2.10
Mean	0.65	1.83	0.90	2.27	0.77	1.98		
CD (P=0.05)								
			At harvest		30 DAH			
Sowing dates			0.03		0.10			
Varieties			0.04		0.08			
Varieties at same date of sowing			0.05		NS			
dates at the same or different varieties			0.02		NS			

The highest seed vigour (%) with Accelerated ageing test of soybean (86.7 %) was recorded with 15th September early sown crop at harvest which was on a par with seed vigour obtained at 15th October sowing. However, 15th December sowing was at par with 15th November sowing for seed vigour at harvest. At 30 days after harvest, the highest seed vigour of soybean (81.2 %) was recorded with 15th September sowing. The seed vigour recorded with 15th October and 15th November sowing were on a par with each other having 76.8 % and 76.4 %, seed vigour respectively (Table-4). A significant decrease in seed vigour was observed due to delay in sowing. This might be due to the decrease in growing Degree Days (GDDs), temperature, moisture content of seed, early maturity. Lipid changes of seed during storage and decline in phospholipids and polyunsaturated fatty acids lead to marked decline in seed vigour as reported by Balesevic-Tubic *et al.* (2010).

At harvest, the maximum EC of 0.90 $dsm^{-1}g^{-1}$ was recorded with 15th November sowing which was significantly superior to all the other dates of sowing. At 30 days after harvest, the maximum EC (2.20 dsm^{-1} g^{-1}) was recorded with 15th November sowing which was significantly superior to rest of the dates of sowing (Table-5). Delayed sowing on November 15th had higher EC, where actually the crop experienced low temperature with high humidity and shorter day length forcing the crop to mature earlier which cumulatively might have resulted in more EC, where the yield was also low. Higher the EC (dsm^{-1} g^{-1}) loss of more leachates leads to less vigour of the seed. Similar results were also reported by Fraczek *et al* (2005).

Effect of varieties

The varieties significantly differed in protein content, germination % at 30 DAH and seed vigour with Accelerated aging test at 30 DAH. However, germination %, and Accelerated ageing test at harvest and seed viability with (Tetrazolium test) both at harvest and 30 DAH was not influenced by varieties. Among the varieties, highest protein content of soybean was recorded with the variety JS-93-05 (35.2 %) which was significantly superior over other two varieties JS-335 (32.5%) and Local (30.5 %). Among the varieties, high protein content was recorded with JS-93-05 might be due to genetic behaviour of the variety. The results are in consonance with Billore *et al.* (2000), Halvankar *et al.* (2001). (Table-1). Among the varieties, the maximum germination percentage (85.8 %) was recorded with JS-93-05 at 30 days after harvest which was significantly superior over the other two varieties tested (Table-2). Among the varieties, the germination percentage at 30 days after harvest was maximum with JS-93-05, this might be due to the genetic makeup of variety, seed size, thickness of the seed coat, moisture content of seed and storage condition. Genotypic differences on soybean seed storability were reported by Agrawal and Kaur (1975), Verma and Gupta (1975). Among the varieties, the highest seed vigour with Accelerated ageing test at 30 DAH

of soybean was recorded with the variety JS-93-05 (80.3 %) which was significantly superior to other two varieties Local (78.3%) and JS-335 (76.5 %) at 30 DAH (Table-4). Rapid loss in viability of soybean seed is largely influenced by the genotype of the variety (Justise and Bass, 1979).

Among the varieties, the highest seed vigour with EC test was recorded with JSS-335 (0.90 dsm^{-1} g^{-1}) which was significantly superior to the other two varieties Local (0.77 dsm^{-1} g^{-1}) and JS-93-05 (0.65 dsm^{-1} g^{-1}) at harvest. Among the varieties, the highest EC (2.27 dsm^{-1} g^{-1}) was recorded with variety JSS-335 which was significantly superior to other two varieties tested at 30 DAH **(Table-5)**.

Interaction effect

Interaction between sowing dates and varieties was significant for seed vigour with EC at harvest. The highest EC (0.98 dsm^{-1} g^{-1}) was recorded with 15th November sowing with variety JSS-335 which was significantly superior to all other combinations at harvest **(Table-5)**.Which indicates low seed vigour as the sowing was delayed.

It can be concluded that seed quality of soybean viz. protein content, germination %, seed viability and vigour was more with early sowing on 15th September with variety JS-93-05 in costal AP.

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