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Effect of Harvesting Stages on Seed Quality of Soybean (*Glycine max* L.) Varieties during Storage

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ABSTRACT

The present investigation was conducted at the Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during kharif-2018, with an aim to study the effect of harvesting stages (H_1=One pod mature in plant, H_2=Physiological maturity, H_3=One week after physiological maturity, and H_4=Two weeks after physiological maturity) on seed quality in different soybean varieties (V_1=GS-1, V_2=GS-2 and V_3=GJS-3) in the storage condition. The seeds harvested as per the treatment combinations from the field experiment were stored in the laboratory for six months and observations viz., moisture content (%), 100 seed weight (g), germination percentage, seedling length (cm), seedling fresh weight (mg), seedling dry weight (mg), seedling vigour index-I, seedling vigour index-II, electrical conductivity of seed leachates (ds/m) and oil content (%) were recorded initially at the time of storage and after six months of storage in the laboratory of the Department of Seed Science and Technology, College of Agriculture, Junagadh Agricultural University, Junagadh. Irrespective of the harvesting stages, the moisture content in the seeds, 100 seed weight and electrical conductivity of seed leachates were increased gradually with increased in storage period, while germination, seedling length, seedling fresh and dry weight, seedling vigour index (I and II) and oil content (%) were decreased gradually with increased in storage period. It was suggested that for getting the higher yield and quality of soybean varieties after six months of storage, soybean seed should be harvested at the H_2 (Physiological maturity stage), as the seeds harvested at physiological maturity stage recorded the germination percentage (77.23 %) even after six months of storage with good vigour. For maintaining better quality up to the next season sowing, seeds could be stored under proper storage condition, because with increase in storage period, quality of seed deteriorated.

Keywords: *Harvesting stages, Seed production, Seed quality, Soybean, Storage*

INTRODUCTION

Soybean (*Glycine max* L.) is considered as miracle crop because of its dual qualities, *viz.*, high protein and oil content in seed. Soybean belongs to the family Fabaceae and sub family Papilionaceae with chromosome number 2n=20. Soybean contains more protein (about 40-42 percent) than other pulses and a much higher content of edible oil (about 20 percent) (Gopalan et al., 1994).

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In India, area, production and productivity of soybean in *kharif* 2015-16 were 11.60 million hectare, 85.69 million metric tons and 738 kg/ha. respectively, while in Gujarat area, production and productivity of soybean in *kharif*-2018 were 1.34 lakh hectare, 1.24 million metric tons and 925 kg/ha., respectively (Anon, 2018).

In modern agriculture, success of seed industry and seed programmes depends on how carefully seeds are stored for next planting without loss of seed viability and vigour. Storability of seed is mainly a genetical character and is influenced by pre-storage history of seed, seed maturation, environmental factors during pre and post harvest stages, etc. (Mahesha et al., 2001). Early harvested seeds will be immature and poorly developed and as such are poor storers compared to seed harvest at physiological maturity (Singh & Lachanna, 1995). At physiological maturity, seed shall have maximum dry weight, viability and vigour. As such harvesting of seed crop at optimum stage of seed maturation is essential to obtain better seed quality. Moisture content of harvested crop affects seed quality throughout the storage of seed and hence, it determines with which moisture content the crop should be threshed. Harvesting at high moisture content increases the changes of mycofloral infection on seed, while at low moisture content increases mechanical damage to seed (Yadav et al., 2005). Harvest of seed crop at right stage of maturity bear significant influence on seed yield and quality, as seeds harvested at right stage of physiological maturity are higher in seed quality on account of lesser field weathering (Bharud & Patil, 1990). Therefore, there is a need to ascertain the optimum stage of harvesting to obtain higher quality seeds and remain that quality during storage.

MATERIALS AND METHODS

The field experiment "Effect of harvesting stages on seed quality of soybean (*Glycine max* L.)" was conducted at the Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during *kharif*-2018, with an aim to study the effect of harvesting stages (H_1=One pod mature in plant, H_2=Physiological maturity, H_3=One week after physiological maturity, and H_4=Two weeks after physiological maturity) on seed quality in different soybean varieties (V_1=GS-1, V_2=GS-2 and V_3=GJS-3) in the field condition. The characters *viz.*, moisture content (%), 100 seed weight (g), germination percentage, seedling length (cm), seedling fresh weight (mg), seedling dry weight (mg), seedling vigour index-I, seedling vigour index-II, electrical conductivity of seed leachates (ds/m) and oil content (%) were recorded initially at the time of storage and after six months of storage as per standard procedure. The data of all characters studied, were subjected statistical analysis of variance technique following Completely Randomized Design (Factorial) for as described by Cochran and Cox (1957).

RESULT AND DISCUSSION

The seed quality parameters during storage depend on the stage at which the seed crop is harvested. The results of the present study on influence of stages of harvest on seed quality in soybean varieties are presented in Table 1, 2 and 3 discussed here as under.

Moisture content (%) (Table 1)

Different varieties of soybean exhibited non-significant difference for moisture content during storage period irrespective of harvesting stages. At the time of storage, the moisture content recorded the highest (7.51 %) in GJS-3. After six months of storage, the moisture content, on an average, increased to 0.4 per cent and it was noted the maximum (7.95 %) in GJS-3. The increase in moisture content of the seeds with increase in storage period might be due to hygroscopic nature of the seed and moisture exchange due to high relative humidity during storage period (Harrington, 1972; Malarkodi, 1997 and Robert, 1986). Irrespective of different varieties tested, different stages of harvest exerted non-significant difference for moisture content during storage period. Initially at the time of storage, the maximum moisture content (7.58 %) was noted in H_1 (One pod mature in plant). After six months of storage, the moisture content, on an average, increased to 0.4 per cent and it was recorded numerically the maximum (7.98 %) in H_1 (One pod mature in plant). The increase in moisture content of the seeds with increase in storage period might be due to hygroscopic nature of the seed and moisture exchange due to high relative humidity during storage period (Harrington, 1972; Malarkodi, 1997 and Robert, 1986).

100 seed weight (g) (Table 1)

Different varieties of soybean exhibited significant difference for 100 seed weight during storage period irrespective of harvesting stages. At the time of storage, 100 seed weight recorded significantly the highest (9.29 g) in GJS-3. After six months of storage, 100 seed weight was noted significantly the maximum (9.71 g) in GJS-3. The increase in 100 seed weight with increase in storage period might be due to hygroscopic nature of the seed and moisture exchange due to high relative humidity during storage period (Harrington, 1972; Malarkodi, 1997 and Robert, 1986). Irrespective of different varieties tested, different stages of harvest exerted significant difference for 100 seed weight during different storage period. Initially at the time of storage, significantly the maximum 100 seed weight (10.04 g) was noted in H_2 (Physiological maturity). It was observed that 100 seed weight was increased gradually with increased in storage period. After six months of storage, the same trend was observed for this trait, as significantly the maximum 100 seed weight (10.68 g) was noted in H_2 (Physiological maturity). The increase in 100 seed weight with increase in storage period might be due to hygroscopic nature of the seed and moisture exchange due to high relative humidity during storage period (Harrington, 1972; Malarkodi, 1997 and Robert 1986). Similar results were also observed by Isaac et al. (2016b) in soybean during storage. In the present study, the highest 100 seed weight was recorded in H_2 (Physiological maturity). In case of soybean, R8 stage (H_2) is considered to be the physiological maturity stage.

Germination percentage (Table 1)

Different varieties of soybean exhibited significant difference for germination during storage period irrespective of harvesting stages. At the time of storage, germination was recorded the highest (89.28 %) in GJS-3. After six months of storage, on an average 15% reduction in germination with the maximum (73.75 %) in GJS-3. The differences in germination noticed among varieties may be ascribed to differences in accumulation of reserve food material in seed and its efficient utilization during germination (Gnyandev, 2009). Similar results were also observed by Mane (2004), Donga (2014) and Isaac et al. (2016b) in soybean during storage. Irrespective of different varieties tested, different stages of harvest exerted significant difference for germination for different storage period. At the time of storage, significantly the maximum germination (95.02 %) was recorded in the seeds harvested at H_2 (Physiological maturity) and it was at par with H_3 (One week after physiological maturity) (93.30 %). After six months of storage, same trend was observed, as significantly the maximum germination (77.23 %) was recorded in the seeds harvested at H_2 (Physiological maturity) and it was at par with H_3 (One week after physiological maturity) (75.95 %). It was observed that germination was decreased gradually with increased in storage period. Similar results were also observed by Venkatareddy et al. (2002), Isaac et al. (2016b) in soybean. Reduction in pod and seed weight and ultimately the germination may be related to inbuilt mechanism, cessation and disorganization of cell organelles within few days from physiological maturity (Mathews, 1973).

Seedling length (cm) (Table 2)

Different varieties of soybean exhibited significant difference for seedling length during storage period irrespective of harvesting stages. At the time of storage, seedling length was recorded significantly the highest (19.92 cm) in GJS-3 After six months of storage, seedling length was noted significantly the maximum (16.17 cm) in GJS-

3. The differences in seedling length noticed among varieties may be ascribed to differences in accumulation of reserve food material in seed and its efficient utilization during germination (Gnyandev, 2009). Similar decreasing trend with storage period was also observed by Donga (2014) in soybean during storage. Irrespective of different varieties tested, different stages of harvest exerted significant difference for seedling length for different storage period. At the time of storage, significantly the maximum seedling length (19.82 cm) was recorded in the seeds harvested at H_2 (Physiological maturity). After six months of storage, same trend was observed, as significantly the maximum seedling length (14.78 cm) was recorded in the seeds harvested at H_2 (Physiological maturity), however it was at par with H_3 (One week after physiological maturity) (14.61 cm). It was observed that seedling length was decreased gradually with increased in storage period. Similar results were also observed by Charjan and Tarrar (1992) and Donga (2014) in soybean during storage.

Seedling fresh weight (mg) (Table 2)

Different varieties of soybean exhibited significant difference for seedling fresh weight during storage period irrespective of harvesting stages. At the time of storage, seedling fresh weight was recorded significantly the highest (3274.17 mg) in GJS-3. After six months of storage, seedling fresh weight was noted significantly the maximum (2015.00 mg) in GJS-3. The differences in seedling fresh weight noticed among varieties may be ascribed to differences in accumulation of reserve food material in seed and its efficient utilization during germination (Gnyandev, 2009). Similar decreasing trend with storage period was also observed by Donga (2014) in soybean during storage. Irrespective of different varieties tested, different stages of harvest exerted significant difference for seedling fresh weight for different storage period. At the time of storage, significantly the maximum seedling fresh weight (3396.67 mg) was recorded in the seeds harvested at H_2 (Physiological maturity), however it was significantly at par with H_3 (One week after physiological maturity) (3306.67 mg). After six months of storage, same trend was observed, as significantly the maximum seedling fresh weight (1873.33 mg) was recorded in the seeds harvested at H_2 (Physiological maturity), however it was significantly at par with H_3 (One week after physiological maturity) (1851.11 mg). It was observed that seedling fresh weight was decreased gradually with increased in storage period. Similar results were also observed by Donga (2014) in soybean during storage.

Seedling dry weight (mg) (Table 2)

Different varieties of soybean exhibited significant difference for seedling dry weight during storage period irrespective of harvesting stages. At the time of storage, seedling dry weight was recorded significantly the highest (336.67 mg) in GJS-3. After six months of storage, seedling dry weight was noted significantly the maximum (191.65 mg) in GJS-3. The differences in seedling dry weight noticed among varieties may be ascribed to differences in accumulation of reserve food material in seed and its efficient utilization during germination (Gnyandev, 2009). Similar decreasing trend with storage period was also observed by Donga (2014) in soybean during storage. Irrespective of different varieties tested, different stages of harvest exerted significant difference for seedling dry weight for different storage period. At the time of storage, significantly the maximum seedling dry weight (322.22 mg) was recorded in the seeds harvested at H_2 (Physiological maturity), however it was at par with H_3 (One week after physiological maturity) (312.22 mg). After six months of storage, same trend was observed, as significantly the maximum seedling dry weight (174.87 mg) was recorded in the seeds harvested at H_2 (Physiological maturity). It was observed that seedling dry weight was decreased gradually with increased in storage period. Similar results were also observed by Charjan and Tarrar (1992) and Donga (2014) in soybean during storage.

Seedling Vigour Index (I) (Table 3)

Irrespective of harvesting stages, different varieties of soybean exhibited significant difference for seedling vigour index-I during storage period irrespective of harvesting stages. At the time of storage, seedling vigour index-I was recorded significantly the highest (1778.45) in GJS-3. After six months of storage, seedling vigour index-I was noted the maximum (1192.54) in GJS-3. The differences in seedling vigour index-I noticed among varieties may be ascribed to differences in accumulation of reserve food material in seed and its efficient utilization during germination (Gnyandev, 2009). Similar decreasing trend with storage period was also observed by Donga (2014) in soybean during storage. Irrespective of different varieties tested, different stages of harvest exerted significant difference for seedling vigour index-I for different storage period. At the time of storage, significantly the maximum seedling vigour index-I (1819.63) was recorded in the seeds harvested at H_2 (Physiological maturity), however it was significantly at par with H_3 (One week after physiological maturity) (1786.70). After six months of storage, same trend was observed, as significantly the maximum seedling vigour index-I (1141.46) was recorded in the seeds harvested at H_2 (Physiological maturity), however it was significantly at par with H_3 (One week after physiological maturity) (1109.63). It was observed that seedling vigour index-I was decreased gradually with increased in storage period. Similar results were also observed by Trawartha et al. (1995), Venkatareddy et al. (2002) and Donga (2014) in soybean during storage.

Seedling Vigour Index (II) (Table 3)

Irrespective of harvesting stages, different varieties of soybean exhibited significant difference for seedling vigour index-II during storage period irrespective of harvesting stages. At the time of storage, seedling vigour index-II was recorded the highest (30094.93) in GJS-3. After six months of storage, seedling vigour index-II was noted the maximum (14134.19) in GJS-3. The differences in seedling vigour index-II noticed among varieties may be ascribed to differences in accumulation of reserve food material in seed and its efficient utilization during germination (Gnyandev, 2009). Similar decreasing trend with storage period was also observed by Donga (2014) in soybean during storage. Irrespective of different varieties tested, different stages of harvest exerted significant difference for seedling vigour index-II for different storage period. At the time of storage, significantly the maximum seedling vigour index-II (30617.34) was recorded in the seeds harvested at H_2 (Physiological maturity). After six months of storage, same trend was observed, as significantly the maximum seedling vigour index-II (13505.21) was recorded in the seeds harvested at H_2 (Physiological maturity). It was observed that seedling vigour index-II was decreased gradually with increased in storage period. Similar results were also observed by Trawartha et al. (1995), Venkatareddy et al. (2002) and Donga (2014) in soybean during storage.

Electrical conductivity of seed leachates (dS/m) (Table 3)

Irrespective of harvesting stages, different varieties of soybean exhibited significant difference for electrical conductivity of seed leachates during different storage period. At the time of storage, electrical conductivity of seed leachates was recorded the highest (0.810 dS/m) in GS-2. After six months of storage, electrical conductivity of seed leachates was noted the maximum (0.957 dS/m) in GS-2. The different electrical conductivity values recorded among varieties indicates that though membrane permeability is lost during seed ageing, the nature and extent of membrane damage may not be similar for all the varieties and thus differences in electrical conductivity values are bound to occur (Kurdikeri, 1991). Similar increasing trend with storage period was also observed by Mane (2004) in soybean during storage. Irrespective of different varieties tested, different stages of harvest exerted significant difference for electrical conductivity of seed leachates for different storage period. At the time of storage, significantly the maximum electrical conductivity of seed leachates (0.736 dS/m) was recorded in the seeds harvested at H_1 (One pod mature in plant). After six months of storage, significantly the maximum electrical conductivity of seed leachates (0.931 ds/m) was recorded in the seeds harvested at the seeds harvested at H_1 (One pod mature in plant). Similar results were also observed by Hampton et al. (1992), Prasad (2002) and Mane (2004) in soybean during storage.

Oil content (%) (Table 3)

Irrespective of harvesting stages, different varieties of soybean exhibited significant difference for oil content during different storage period. At the time of storage, oil content was recorded the highest (20.30 %) in GJS-3. After six months of storage, oil content was noted the maximum (20.11 %) in GJS-3. The different oil content values recorded among varieties indicates that oil content readily oxidizes, which enhances deterioration of the seed in storage. Therefore, the reduction could be attributed to oxidation during storage. According to Balesevic-Tubic et al. (2007), the chemical composition of oilseeds causes specific processes to occur during storage. The seeds rich in lipids have limited longevity due to their specific chemical compostion. Soybean seed storage demands special attention due to its oil content, otherwise processes may occur that would lead to the loss of germination ability and seed viability (Balesevic-Tubic et al., 2007). Irrespective of different varieties tested, different stages of harvest exerted significant difference for oil content for different storage period. At the time of storage, significantly the maximum oil content (20.11 %) was recorded in the seeds harvested at H_2 (Physiological maturity), however it was significantly at par with H_3 (One week after physiological maturity) (19.99 %). After six months of storage, significantly the maximum oil content (20.00 %) was recorded in the seeds harvested at the seeds harvested at H_2 (Physiological maturity), however it was significantly at par with H_3 (One week after physiological maturity) (19.93 %).

Table 1: Influence of stages of harvest on moisture content (%), 100 seed weight (g) and germination percentage in chickpea varieties during storage

Treatments	Moisture content (%)		100 seed weight (g)		Germination percentage	
	Initial at the time of storage	6 months after storage	Initial at the time of storage	6 months after storage	Initial at the time of storage	6 months after storage
Varieties (V)						
GS-1 (V_1)	7.36	7.78	7.12	7.99	86.10	71.54
GS-2 (V_2)	7.40	7.85	8.64	8.89	83.39	69.73
GJS-3 (V_3)	7.51	7.95	9.29	9.71	89.28	73.75
S. Em±	0.06	0.05	0.25	0.12	0.80	0.54
C. D. at 5%	NS	NS	0.74	0.36	2.35	1.56
Harvesting stages (H)						
One pod mature in	7.58	7.98	7.02	7.45	73.97	62.46
Physiological	7.44	7.85	10.04	10.68	95.02	77.23
One week after physiological	7.36	7.82	9.03	9.54	93.30	75.95
Two weeks after physiological	7.32	7.79	7.33	7.78	82.74	71.05
S. Em±	0.07	0.05	0.29	0.14	0.93	0.62
C. D. at 5%	NS	NS	0.86	0.42	2.71	1.82
Varieties (V) x Harvesting stages (H)						
V_1 x H_1	7.50	7.90	5.92	6.49	75.33	63.42

V_1 x H_2	7.38	7.80	8.32	9.63	95.19	77.34
V_1 x H_3	7.30	7.76	7.59	8.51	93.95	76.37
V_1 x H_4	7.25	7.68	6.65	7.33	79.94	69.01
V_2 x H_1	7.60	8.01	7.32	7.58	69.35	59.20
V_2 x H_2	7.43	7.83	10.27	10.39	92.30	75.47
V_2 x H_3	7.32	7.79	9.47	9.75	90.39	74.06
V_2 x H_4	7.27	7.78	7.51	7.85	81.54	70.18
V_3 x H_1	7.64	8.05	7.81	8.27	77.23	64.74
V_3 x H_2	7.50	7.92	11.51	12.02	97.57	78.88
V_3 x H_3	7.47	7.92	10.01	10.38	95.55	77.40
V_3 x H_4	7.44	7.90	7.83	8.17	86.75	73.97
Mean	7.43	7.86	8.36	8.86	86.26	71.67
S. Em±	0.12	0.09	0.51	0.25	1.61	1.08
C. D. at 5%	NS	NS	NS	NS	NS	NS
CV %	2.78	2.03	10.53	4.88	3.23	2.61

Table 2: Influence of stages of harvest on seedling length (cm), seedling fresh weight (mg), seedling dry weight (mg) in chickpea varieties during storage

Treatments	**Seedling length (cm)**		**Seedling fresh weight (mg)**		**Seedling dry weight (mg)**	
	Initial at the time of storage	**6 months after storage**	**Initial at the time of storage**	**6 months after storage**	**Initial at the time of storage**	**6 months after storage**
Varieties (V)						
GS-1 (V_1)	18.32	13.52	2985.83	1704.17	263.33	138.13
GS-2 (V_2)	18.01	13.12	2934.17	1635.83	233.33	107.57
GJS-3 (V_3)	19.92	16.17	3274.17	2015.00	336.67	191.65
S. Em±	0.13	0.08	32.15	9.59	3.40	2.07
C. D. at 5%	0.37	0.24	93.83	27.98	9.93	6.06
Harvesting stages (H)						
One pod mature in	17.73	13.55	2615.56	1655.56	222.22	108.50
Physiological	19.82	14.78	3396.67	1873.33	322.22	174.87
One week after physiological	19.15	14.61	3306.67	1851.11	312.22	165.79
Two weeks after physiological	18.28	14.18	2940.00	1760.00	254.44	133.98
S. Em±	0.15	0.10	37.12	11.07	3.93	2.40
C. D. at 5%	0.43	0.28	108.34	32.31	11.47	6.99
Varieties (V) x Harvesting stages (H)						
V_1 x H_1	17.43	12.93	2560.00	1586.67	206.67	96.30
V_1 x H_2	19.17	13.88	3363.33	1800.00	306.67	170.75
V_1 x H_3	18.79	13.86	3210.00	1766.67	293.33	161.51
V_1 x H_4	17.89	13.45	2810.00	1663.33	246.67	123.97
V_2 x H_1	17.07	12.52	2503.33	1523.33	176.67	80.37
V_2 x H_2	19.02	13.54	3266.67	1720.00	273.33	130.99
V_2 x H_3	18.32	13.37	3240.00	1710.00	276.67	123.26

V_2 x H_4	17.61	13.06	2726.67	1590.00	206.67	95.66
V_3 x H_1	18.71	15.16	2783.33	1856.67	283.33	148.82
V_3 x H_2	21.28	16.91	3560.00	2100.00	386.67	222.85
V_3 x H_3	20.34	16.61	3470.00	2076.67	366.67	212.60
V_3 x H_4	19.34	16.03	3283.33	2026.67	310.00	182.32
Mean	18.75	14.28	3064.73	1785.00	277.78	145.79
S. Em±	0.26	0.17	64.29	19.17	6.80	4.15
C. D. at 5%	NS	NS	NS	NS	NS	NS
CV %	2.37	2.03	3.63	1.86	4.24	4.93

Table 3: Influence of stages of harvest on Seedling Vigour Index-I, Seedling Vigour Index-II, Electrical conductivity of seed leachates (dS/m) and oil content (%) in chickpea varieties during storage

Treatments	Seedling vigour index-I		Seedling vigour index-II		Electrical conductivity (dS/m)		Oil content (%)	
	Initial at the time of storage	6 months after storage	Initial at the time of storage	6 months after storage	Initial at the time of storage	6 months after storage	Initial at the time of storage	6 months after storage
Varieties (V)								
GS-1 (V_1)	1577.35	967.22	22672.71	9881.82	0.687	0.829	19.53	19.43
GS-2 (V_2)	1501.85	914.86	19457.39	7500.86	0.810	0.957	19.88	19.79
GJS-3 (V_3)	1778.45	1192.54	30094.93	14134.19	0.580	0.724	20.30	20.11
S. Em±	19.47	10.14	366.79	157.32	0.004	0.004	0.09	0.07
C. D. at 5%	56.84	29.58	1070.59	459.20	0.012	0.013	0.25	0.21
Harvesting stages (H)								
One pod mature in plant (H_1)	1311.49	846.33	16437.61	6776.91	0.736	0.931	19.72	19.59
Physiological maturity (H_2)	1819.63	1141.46	30617.34	13505.21	0.649	0.743	20.11	20.00
One week after physiological maturity (H_3)	1786.70	1109.63	29130.13	12591.75	0.663	0.767	19.99	19.93
Two weeks after physiological maturity (H_4)	1512.49	1007.49	21052.37	9519.28	0.664	0.906	19.81	19.58
S. Em±	22.49	11.70	423.54	181.66	0.005	0.005	0.10	0.08
C. D. at 5%	65.63	34.16	1236.21	530.24	0.015	0.015	0.29	0.24
Varieties (V) x Harvesting stages (H)								
V_1 x H_1	1313.00	820.02	15568.45	6107.35	0.743	0.930	19.40	19.25
V_1 x H_2	1824.79	1073.48	29191.92	13205.81	0.647	0.747	19.70	19.61
V_1 x H_3	1765.32	1058.49	27558.35	12334.52	0.649	0.757	19.60	19.54
V_1 x H_4	1430.13	928.18	19718.80	8555.17	0.707	0.883	19.43	19.32
V_2 x H_1	1183.80	741.18	12252.06	4757.90	0.851	1.059	19.70	19.57
V_2 x H_2	1755.55	1021.86	25228.36	9885.82	0.763	0.851	20.08	20.00
V_2 x H_3	1655.94	990.18	25008.36	9128.64	0.790	0.879	19.96	19.92
V_2 x H_4	1435.92	916.55	16851.87	6713.42	0.838	1.040	19.79	19.69
V_3 x H_1	1444.97	981.46	21881.58	9634.61	0.616	0.806	20.06	19.95
V_3 x H_2	2076.29	1333.86	37727.39	17578.41	0.536	0.631	20.54	20.40
V_3 x H_3	1943.49	1285.61	35035.32	16455.24	0.553	0.665	20.40	20.35
V_3 x H_4	1677.75	1185.74	26892.50	13486.21	0.615	0.796	20.21	19.75

Mean	1607.58	1026.23	24309.36	10598.29	0.678	0.837	19.91	19.78
S. Em±	38.95	20.27	733.58	314.65	0.009	0.009	0.17	0.14
C. D. at 5%	NS	NS	NS	918.40	NS	NS	NS	NS
CV %	4.15	3.42	5.21	5.12	2.16	1.84	1.47	1.26

CONCLUSION

For getting the higher yield and quality of soybean varieties at the time of storage and after six months of storage, soybean seed should be harvested at the H_2 (Physiological maturity stage), as the seeds harvested at physiological maturity stage recorded the germination percentage (77.23 %) even after six months of storage with good vigour. For maintaining better quality up to the next season sowing, seeds could be stored under proper storage condition, because with increase in storage period, quality of seed deteriorated.

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