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EFFECT OF SEASONAL VARIATION ON TUBER BULKING RATE OF POTATO

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ABSTRACT

Field trial was conducted to optimize the sowing date and crop growth period of potato at the Agricultural Research Institute, Dera Ismail Khan, NWFP during 2004-05. The tubers were planted on four dates with one-week interval starting from September 24 in 2004. Tubers planted at each sowing date were harvested on six different dates starting from week-10 and ending at week-15. Total number of stems increased with the delay in planting. Total numbers of tubers per unit area and percentage of large sized tubers (> 55 mm) were the highest at the earliest planting of September 24. Smaller tubers (< 35 mm) increased with delay in planting. Total tuber yield was higher at earlier planting as compared to planting at later dates. However, dry matter was higher at delayed planting. Plant dry bio-mass was higher by planting the potato earlier. Harvesting potato at various intervals also affected these parameters significantly. Total number of tubers, percent larger and medium sized tubers, tuber yield and plant dry bio-mass increased with the delay in harvesting. However, dry matter in tuber was found higher at earlier harvestings.

Key words: Potato, Sowing dates, Harvesting dates

INTRODUCTION

The growth cycle of the potato can be roughly divided into five stages; sprout development, vegetative growth, tuber initiation, tuber bulking and maturation. The eyes of the potato develop sprouts, which emerge from the soil. Growth and quality of potato is influenced by environmental factors such as temperature, moisture, light, soil type and nutrients. Many factors influencing potato growth are largely uncontrollable: length of growing season, air and soil temperatures, light intensity and duration, humidity and wind. Other factors that influence growth of the crop can be controlled by the grower: variety of potato, size of mother seed tubers, seed-piece cutting, seed-piece types, cut-seed size, planter operation, plant stand, stem population, moisture, nutrition, pest management, planting date and harvest dates. Since tuber initiation occurs early in the season, therefore optimum soil temperature (16-19 C) is needed. While tuber development requires temperature of 20^{o} C. Yields are highest when average daytime temperatures are about 21 ^{0}C. From temperature information growing degree days can be calculated. Growing degree days are a measure of heat useful for the growth and development of any crop. Most of the potato varieties require above 800 degree days to reach maturity. On the other hand a minimum of 70-90 days of favorable cool season is required to obtain an economical potato yield. However, a longer favorable season up to 110-120 days along with enough accumulated heat units result in substantially higher returns. Altering the planting and harvesting times can influence the accumulation of heat units and ultimately the potato yield. Khan *et al.* (1990) reported that delay in harvesting till 100 days after planting results in higher yield. De-Buchananne and Lawson (1991) obtained an alleviated yield and specific gravity for two cultivars when harvested 16 weeks at two locations. Saunders and Hutchinson (1984) reported an increased yield with successive delay in harvest for four years. In another study it was observed that potato tuber yield was increased by late harvesting (Workman and Harrison, 1982). Dera Ismail khan district of Pakistan is located at 31.8 N 70.9 E. Favorable environmental conditions during the autumn growing season can permit to grow potato, however, no studies have been carried out on this important crop in the area. The present studies were, therefore, conducted to determine the best period which can produce maximum tuber yield.

MATERIALS AND METHODS

The trial was laid out in a randomized complete block design (factorial) with four replications at Agricultural Research Institute, Dera Ismail Khan during 2004-05. Plot size was 4 x 3 m^2, having plant-to-plant and row-to-row spacing 10cm and 75cm, respectively. Red skin cultivar "Cardinal" was used in this experiment. Fertilizers were applied @ 120:100:80 kg ha^{-1}. Weeds were controlled manually once 45 days after planting. To observe the effects of climate, tubers were planted on four different dates i.e. September 24, October 01, October 07 and October 15. The plots planted on each planting date were harvested after 10, 11, 12, 13, 14 and 15 weeks after planting. Observations recorded were number of stem/plant, total number of tubers, percent large (>55 mm), medium (35 to 55 mm) and small sized

tubers (<35 mm), dry matter accumulation and potato vine dry weight. Growing degree days were calculated for each treatment and yield was compared with calculated growing degree days. Maximum, minimum and average temperatures were recorded and presented in Fig-1.

Data collected were analyzed in randomized block design with two factors using Mstatc, while means were compared by the LSD test. (Steel *et al*., 1997).

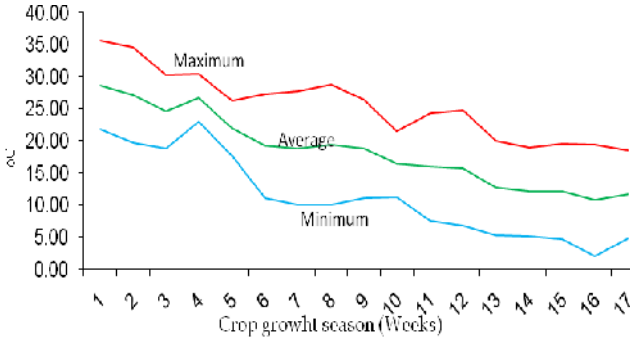

Fig- 1 Temperatures (°C) recorded during the potato growing season at D.I.Khan (Sep. 24, 2004 to Jan. 26, 2005)

RESULTS AND DISCUSSION

Number of stems (plant^{-1}): A significant difference was observed in number of stems per plant among all four sowing dates (Table-1). The earliest sowing on Sep- 24 resulted in 3.42 stems per plant. Sowing potato on Oct-01 and Oct-07, 2004 resulted in 3.38 and 3.97 stems per plant, respectively. The highest numbers of stems per plant (4.16) were recorded in the last sowing of Oct-15, 2004. Differences among the harvesting dates were found non-significant statistically. Interaction between the sowing dates and harvesting dates was also found non-significant. It was observed that delay in planting resulted in increased number of stem plant^{-1}. Tubers used for planting in autumn are stored in cold storage from February to September. The tubers are taken out of storage and kept at room temperature for one to two weeks where they take time and sprouts before they get planted. Seed tubers used for the present study were taken out of the cold store in the month of September just before the first sowing. Rest of the seed was kept at room temperature and was planted every week for successive dates of sowing. The seed tubers planted at the earliest dates received shorter time at room temperature as compared to tubers used for later plantings. Earlier planted tubers produced lesser sprouts before sowing while tubers planted later had already sprouted and produced maximum number of sprouts before sowing, which finally resulted in higher number of stems per plant at late planting. Bohl *et al.* (1995) compared the seed tubers of two ages; old vs. young and reported that young seed grew slower and produced fewer stems per hill while older seed had rapid growth and produced more stems per hill.

Total number of tubers m^{-2}: Total number of tubers harvested is presented in Table-2, which revealed significant effect of various planting dates and harvesting time. Tubers planted on Sep-24 produced maximum number of tubers (46.77) followed by 42.52 tubers in the plots planted on Oct-15. Planting tubers on Oct-07 produced 37.18 tubers m^{-2}. Seed tubers planted on Oct-01 resulted in least number of tubers (30.34 m^{-2}). Providing the crop with maximum period (15 weeks) in the field produced maximum number of tubers (44.69 m^{-2}) that was statistically similar to the tubers (43.77 per m^2) harvested after 14 weeks. Minimum number of tubers (31.66) was recorded after 10 weeks harvesting. Total number of tubers was maximum at the earliest planting. Since earlier planting resulted in faster plant growth, and probably because of optimal environmental condition like temperature for plant growth during the first few weeks of crop development reflected in good tuber count. In addition, when harvesting was delayed plants had more time to support the tubers initiated during the earlier period of plant growth. The results obtained are fairly supported by the findings of Sharma and Verma (1987), who planted potato on different dates and found that earlier planting produced more number of tubers per plant. Robert *et al.* (1990) reported that delay in harvesting results in increased number of tubers per plant.

Percent large tubers plot^{-1}(>55): Planting and harvesting times both significantly affected the tubers above 55 mm (Table-3). Maximum percentage of large tubers (11.29%) was recorded in plots planted on Sep-24 during followed by 11.88% by planting both on Oct-01 and Oct-07. The lowest percentage of large tubers (9.67%) was observed by planting potato on Oct-15. Allowing the crop to grow for the longest period (15 weeks) significantly increased the size of tubers to 17.38% of larger size (>55 mm). Harvesting after 14 weeks produced 16.00% large sized tubers, which were statistically similar to the tubers, produced after 15 weeks. Decreasing the growing period reduced the percentage of large sized tubers in all plots. Harvesting after 13 and 12 weeks produced 13.81 and 10.88% of larger size tubers, respectively. The minimum large sized tubers (only 2.75%) were harvested when crop was allowed to grow for 10 weeks. Interaction between planting and harvesting times was found significant statistically. Planting on Oct-07 and harvesting it after 15 weeks resulted in maximum large sized tubers (19.00%) while only 0.75% of larger sized tubers were harvested when planted on Sep-24 and harvested after 10 weeks. Since earlier planting improved vegetative growth and provided longer period of favor conditions to the plants therefore the same planting resulted in higher number of

large sized tubers. Similarly delayed planting provided longer period to the tubers to grow larger. Ahmad and Rashid (1980) have reported the similar trend of producing larger tubers at earlier plantings.

Percent medium tubers plot^{-1} (35-55 mm): Medium sized tubers were significantly affected by harvesting time (Table-4). Maximum medium sized tubers (15.63%) were harvested when crop was planted on Sep-24 followed by 15.21 and 15.13% when planted on Oct-01 and Oct-07, respectively. Planting the crop on Oct-15 produced least percentage of medium sized tubers (14.54%). Various growing periods significantly affected the amount of medium sized tubers during the study. Harvesting the crop after 15 weeks resulted in the highest percentage (19.63%) of medium sized tubers followed by 18.38% harvested 14 weeks after planting, however differences between these two growing periods were statistically similar. Harvesting the potatoes after 13 and 12 weeks produced statistically similar 16.63 and 15.19% medium sized tubers, respectively. Growing the crop for 11 weeks produced 12.44% medium sized tubers. While harvesting crop after 10 weeks gave 8.50% medium sized tubers. Interaction between the two factors was significant statistically. Planting the crop on Sep-4 and allowing it to grow for 15 weeks resulted in the highest percentage of medium sized tubers (23.25) while the lowest percentage (7.00%) was noted when potatoes were planted on Oct-07 and harvested after 10 weeks after planting. Data recorded for the large and medium sized tubers revealed the trend of earlier planting with higher percentage of marketable tubers. Although the period given to the tubers to grow is important for their development and growth but temperature also plays an important role toward development of marketable tubers. Tubers planted at earlier dates received more time of optimum temperatures than the late planting, which resulted in higher percentage of marketable tubers. On the other hand, delay in harvesting always produced maximum number of marketable tubers, i.e. longer the period the better the tuber size. The data trend set in the interaction reveals that it is not just the crop development period affected the greater number of large and medium sized tubers, the earlier planting when combined with the elevated crop development period (15 weeks) resulted in more tubers of large size. The phenomenon is well supported by Ahmad and Rashid (1980) and Niaz (1998) who recorded reduced tuber count with delay in planting. In the present study planting on Sep-24 provided maximum period of optimal temperature and sun shine for crop development (Fig-1) which resulted in excellent foliage growth with improved photosynthesis which ultimately helped increasing the size of tubers.

Percent small tubers (<35 mm): A reverse trend was observed for small tubers (Table-5). Delay in planting significantly increased the number of small sized tubers (<35 mm). The highest percentage of small sized tubers (75.79%) was recorded in plots planted on Oct-15. The other three sowing dates showed statistically similar percentage of small sized tubers. Planting on Sep-24, Oct-01 and Oct-07 produced 73.08, 72.92 and 73.00% small tubers, respectively. Delay in harvesting resulted in lower percentage of small sized tubers. The highest percentage of small sized tubers (88.75%) was recorded when crop was harvested after 10 weeks. Harvesting after 11 weeks resulted in 81.31% of small sized tubers followed 73.94%, 69.56% and 65.63% by harvesting after 12, 13 and 14 weeks after planting. The lowest percentage of small sized tubers (63.00%) was noted when crop was harvested after 15 weeks. Interaction between the two factors was found significant statistically. The lowest percentage of small sized tubers (58.75%) was obtained from planting tubers Sep-24 and crop was harvested after 15 weeks while the highest percentage (91.25%) was recorded when crop was planted on Sep-24 and harvested after 10 weeks.

Delayed planting and earlier harvesting resulted in higher percentage of small sized tubers. The same trend, as observed in present work, has been reported by Torres (1979) who observed that late planting and early harvesting always produced higher percentage of small sized tubers. Plant growth at delayed planting significantly reduced the vegetable growth of the potato plant because of lower temperatures in the end of October and earlier November. It was most likely that tuber initiated could get larger in size but poor vegetative growth, at late planting with shortened growth period, was unable to transform sufficient energy to the tubers due to sub-optimal environmental conditions.

Tuber yield (t ha^{-1}): Planting the tubers on various dates significantly affected the tuber yield (Table-6 and Fig-2 & Fig-3). Planting the tubers on Sep-24 (the earliest planting) resulted in the highest tuber yield (15.57 t ha^{-1}), followed by 13.72 t ha^{-1} and 13.02 t ha^{-1} on Oct-01 and Oct-07, respectively. Minimum yield (12.69 t ha^{-1}) was obtained by planting on Oct-15. Harvesting the crop after various periods affected the yield significantly. Maximum yield of 15.38 t ha^{-1} was obtained when crop was harvested after 15 weeks. This yield was statistically similar to the yield obtained after 14 and 13 weeks i.e. 14.75 and 14.61 t ha^{-1}, respectively. Harvesting the potato crop after 12 weeks resulted in 14.32 57 t ha^{-1} followed by 13.28 t ha^{-1} harvested after 11 weeks. Minimum yield of 10.14 t ha^{-1} was obtained when tubers were harvested 10 weeks after planting. Interaction between the two factors was non-significantly statistically.

Since earlier planting and late harvesting produced higher percentage of larger and medium sized tubers, this also contributed to the total yield. As the planting delayed the yield was reduced. On the other hand delaying the harvesting improved the yield. Similar

results have also been reported by Khan *et al.* (1990). Other studies also confirm that potato tuber yield increased with late harvesting (Workman and Harrison, 1982). Data collected also support the results regarding tuber yield as the vegetative growth was significantly improved by planting the crop earlier and harvesting later, which increased the number of large and medium sized tubers and decreased the small sized tubers. Accumulated heat unit presented in Fig-4 showed that as the heat units increase the yield increased.

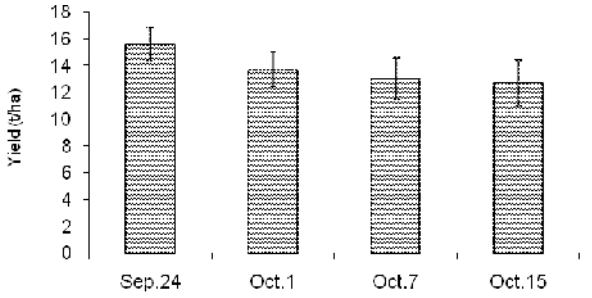

Fig-2 Potato tuber yield (t/ha) as influenced by four sowing dates during 2004-05

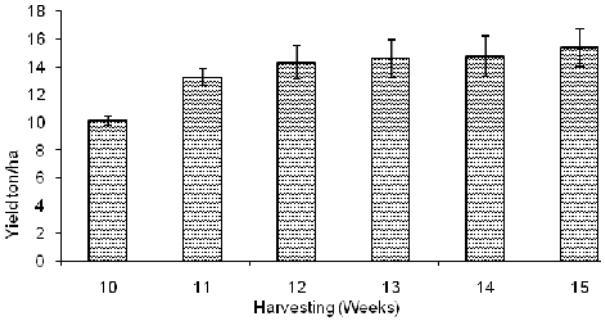

Fig-3 Potato tuber yield (t/ha) as influenced by six harvesting dates

Dry matter in tubers (%): Tubers' dry matter is an important element of industries' interest. It was observed that delay in planting helped in improving the dry matter accumulation (Table-7).

Tubers' dry matter was increased with delay in planting. The highest percentage of dry matter (18.31%) was recorded when tubers were planted on Oct-15 (the last planting date), however, differences among the four planting dates were found non-significant statistically. Delaying the harvesting decreased dry matter production. Significantly lowest dry matter of 14.25% was recorded when tubers were harvested after 15 weeks. All other harvesting periods resulted in statistically similar percentage of dry matter in the tubers. However, interaction between the two factors significantly affected the tubers' dry matter. The highest percentage of 20.82% was recorded when crop was planted on Oct-15 and harvested after 10 weeks. The lowest dry matter (10.31%) was obtained when crop was planted on Oct-01.

The potato crop grows continuously if not harvested, and the newly grown vegetative parts starts utilizing the food already accumulated in the tubers underground. This might be the reason that tubers loose dry matter after some specific period of time if not harvested. Toolangi (1995) provided detail information about the effects of climate and cultural practices on dry matter accumulation in potato and reported that dry matter of the same variety may vary considerably from season to season in the same locality. These variations can be the result of differences in the time of planting, soil moisture, temperature, etc. Temperature probably has one of the greatest effects. At high temperatures increased respiration rates mean that solids accumulated through photosynthesis are burnt up more quickly than they were formed, resulting in a decrease in dry matter. If night temperatures are also high this effect will be even greater. The potato is classified as a "cool season" crop and so temperature probably has more effect on dry matter than any other single environmental factor. Continual cloud cover will decrease dry matter by reducing the photosynthetic rate, and also by the moisture effect if rain accompanies the cloud.

Vines dry bio-mass (kg plant^{-1}): Better vine growth is an important factor in producing higher tuber yield. The potato plant grows well at temperatures between 20 and 25 ^{o}C (Beukema and Van Der Zaag 1990). Table-8 shows that vine dry bio-mass was maximum at the earliest planting and it decreased with delay in planting. Maximum dry bio-mass of 0.268 kg plant^{-1} was recorded when tubers were planted on Sep-24. Planting on Oct-01 and Oct-07 produced the plants of similar weight statistically i.e. 0.242 and 0.244 kg plant^{-1}, respectively. Planting the crop on Oct-15 resulted in 0.214 kg plant^{-1}. While delay in harvesting resulted in increased vine dry bio-mass. The highest vine dry-mass (0.283 kg plant^{-1}) was recorded when crop was harvested 15 weeks after planting, followed by 0.272 and 0.255 kg plant^{-1} recorded when crop was harvested after 14 and 13 weeks, respectively. Performing the harvest after 12 weeks produced the plants with 0.236 kg plant^{-1} vine dry bio-mass. Minimum vine dry bio-mass of 0.193 kg plant^{-1} was recorded when crop was harvested after 10 weeks and this bio-mass was statistically similar to the mass (0.213 kg plant^{-1}) recorded after 11 weeks. Since temperature goes down during the month of October which slows down the sprouting and suppresses the plant growth which ultimately results in lower total plant top dry weight. While delaying the harvest provide a longer period to plants thus increasing the vegetative parts.

Accumulated heat units: Relationship between calculated heat units and yield for each treatment is shown in Fig-4. The trend shows that accumulated heat

units decreased with each successive sowing while units increased with each successive harvesting. Maximum period of optimum growing temperatures (Fig-1) and maximum accumulated heat units during earlier sowings improved the vegetative growth and plant dry matter which ultimately resulted in higher marketable tuber yield.

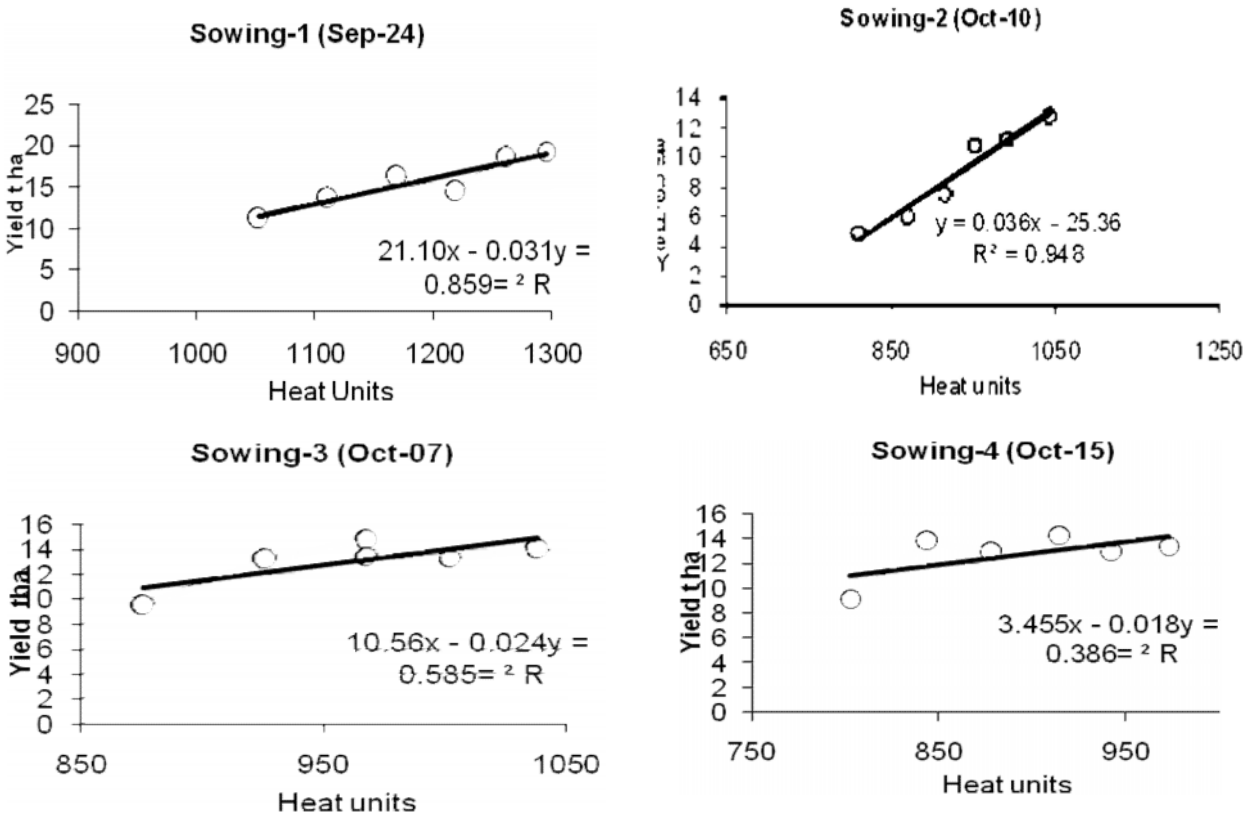

Fig-4 Relationship between heat units and potato yield at four sowing dates and six havesting intervals.

Table-1.Number of stems (plant^{-1}) as affected by sowing and harvesting times in potato during 2004-05.

Sowing Time	Harvesting (Weeks after planting)						Mean
	10	11	12	13	14	15	
Sep-24	3.86	3.08	3.58	3.65	3.47	3.48	3.52 b
Oct-01	3.32	3.17	4.90	3.47	3.63	3.27	3.48 b
Oct-07	4.16	3.95	4.19	3.65	4.19	4.30	4.07 a
Oct-15	4.50	3.76	4.86	3.95	3.61	4.27	4.16 a
Mean	3.96	3.49	4.16	3.61	3.72	3.83	

WAP = Weeks after planting, $LSD_{0.05}$ (sowing time) = 0.4283, Means followed by different letter (s) in a column are significant at 5% level of probability.

Table-2 Total number of tubers (m^{-1}) as affected by sowing and harvesting times in potato during 2004-05.

Sowing Time	Harvesting (Weeks after planting)						Mean
	10	**11**	**12**	**13**	**14**	**15**	
Sep-24	40.75	43.65	45.00	46.55	51.40	53.25	46.77 a
Oct-01	23.30	26.75	28.55	32.50	34.70	36.25	30.34 d
Oct-07	28.65	34.75	37.70	39.15	41.60	41.25	37.18 c
Oct-15	33.95	38.80	41.30	45.80	47.25	48.00	42.52 b
Mean	31.66 d	35.99 c	38.14 c	41.00 b	43.77 a	44.69 a	

WAP = Weeks after planting, $LSD_{0.05}$ (sowing time) = 2.143, $LSD_{0.05}$ (harvesting time) = 2.624 ,Means followed by different letter (s) in a column are significant at 5% level of probability.

Table-3. Large tubers (%) as affected by sowing and harvesting times in potato during 2004-05.

Sowing Time	Harvesting (Weeks after planting)						Mean
	10	11	12	13	14	15	
Sep-24	0.75 n	3.25 mn	11.50 fgh	15.75 a-d	18.50 ab	18.00 abc	11.29 a
Oct-01	1.75 mn	7.25 ijk	12.25 efg	16.25 a-d	16.25 a-d	17.50 abc	11.88 a
Oct-07	4.75 klm	7.75 ijk	11.50 fgh	13.00 d-g	15.25 b-e	19.00 a	11.88 a
Oct-15	3.75 lmn	6.75 jkl	8.25 hij	10.25 ghi	14.00 def	15.00 cde	9.67 b
Mean	2.75 e	6.25 d	10.88 c	13.18 b	16.00 a	17.38 a	

WAP = Weeks after planting, $LSD_{0.05}$ (sowing time) = 1.351, $LSD_{0.05}$ (harvesting time) = 1.655,
$LSD_{0.05}$ (harvesting X sowing time) = 3.310, Means followed by different letter (s) in a column are significant at 5% level of probability.

Table-4. Medium tubers (%) as affected by sowing and harvesting times in potato during 2004-05.

Sowing Time	Harvesting (Weeks after planting)						Mean
	10	11	12	13	14	15	
Sep-24	8.00 ij	11.00 hi	13.50 gh	17.75 b-e	20.25 ab	23.25 a	15.63
Oct-01	9.00 ij	11.00 hi	16.00 d-g	16.75 c-g	18.50 bcd	20.00 abc	15.21
Oct-07	7.00 j	13.75 fgh	15.75 d-g	17.00 b-f	18.50 bcd	18.75 bcd	15.13
Oct-15	10.00 ij	14.00 fgh	15.00 d-g	15.00 efg	16.25 d-g	16.50 d-g	14.54
Mean	8.50 d	12.44 c	15.19 b	16.63 b	18.38 a	19.63 a	

WAP = Weeks after planting, $LSD_{0.05}$ (harvesting time) = 1.638, $LSD_{0.05}$ (harvesting X sowing time) = 3.276
Means followed by different letter (s) in a column are significant at 5% level of probability.

Table-5. Small tubers (%) as affected by sowing and harvesting times in potato during 2004-05.

Sowing Time	Harvesting (Weeks after planting)						Mean
	10	11	12	13	14	15	
Sep-24	91.25 a	85.75 bc	75.00 efg	66.50 kl	61.25 mn	58.75 n	73.08 b
Oct-01	89.25 ab	81.75 cd	71.75 f-j	67.00 jkl	65.25 klm	62.50 lmn	72.92 b
Oct-07	88.25 ab	78.50 de	72.75 f-i	70.00 g-k	66.25 klm	62.25 lmn	73.00 b
Oct-15	86.25 abc	79.25 de	76.75 ef	74.75 e-h	69.75 h-k	68.50 ijk	75.79 a
Mean	88.75 a	81.31. b	73.94 c	69.56 d	65.63 e	63.00 f	

WAP = Weeks after planting, $LSD_{0.05}$ (sowing time) = 2.050, $LSD_{0.05}$ (harvesting time) = 2.511,
$LSD_{0.05}$ (harvesting X sowing time) = 5.022, Means followed by different letter (s) in a column are significant at 5% level of probability.

Table-6. Tuber yield (t ha^{-1}) as affected by sowing and harvesting times in potato during 2004-05.

Sowing Time	Harvesting (Weeks after planting)						Mean
	10	11	12	13	14	15	
Sep-24	11.19	13.61	16.27	14.49	18.53	19.30	15.57 a
Oct-01	10.83	12.57	13.41	16.31	14.22	14.97	13.72 b
Oct-07	9.47	13.17	14.69	13.45	13.34	13.97	13.02 bc
Oct-15	9.06	13.77	12.90	14.19	12.92	13.28	12.69 c
Mean	10.14 c	13.28 b	14.32 ab	14.61 a	14.75 a	15.38 a	

WAP = Weeks after planting, $LSD_{0.05}$ (sowing time) = 0.8774, $LSD_{0.05}$ (harvesting time) = 1.075, $LSD_{0.05}$ (harvesting X sowing time) = 2.149, Means followed by different letter (s) in a column are significant at 5% level of probability.

Table-7. Dry matter (%) as affected by sowing and harvesting times in potato during 2004-05.

Sowing Time	Harvesting (Weeks after planting)						Mean
	10	11	12	13	14	15	
Sep-24	16.80 a-d	17.20 abc	15.93 bcd	19.63.abc	17.95 abc	13.42 de	16.96
Oct-01	18.56 abc	19.33 abc	20.56 a	17.74 abc	15.90 bcd	10.29 e	17.06
Oct-07	18.88 abc	16.29 bcd	16.12 bcd	18.92 abc	16.35 bcd	13.53 de	16.68
Oct-15	20.82 a	15.83 cd	16.21 bcd	18.25 abc	19.52 abc	19.75 ab	18.31
Mean	18.63 a	17.36 a	17.20 a	18.63 a	17.43 a	14.25 b	

WAP = Weeks after planting, $LSD_{0.05}$ (harvesting time) = 1.955 , $LSD_{0.05}$ (harvesting X sowing time) = 3.910
Means followed by different letter (s) in a column are significant at 5% level of probability.

Table-8. Vine dry bio-mass (kg plant^{-1}) as affected by sowing and harvesting times in potato during 2004-05.

Sowing Time	Harvesting (Weeks after planting)						Mean
	10	11	12	13	14	15	
Sep-24	0.193	0.255	0.262	0.277	0.300	0.322	0.268 a
Oct-01	0.207	0.220	0.245	0.261	0.245	0.273	0.242 b
Oct-07	0.207	0.192	0.240	0.247	0.295	0.283	0.244 b
Oct-15	0.162	0.185	0.198	0.235	0.247	0.255	0.214 c
Mean	0.193 d	0.213 d	0.236 c	0.255 bc	0.272 ab	0.283 a	

WAP = Weeks after planting, $LSD_{0.05}$ (sowing time) = 0.01821, $LSD_{0.05}$ (harvesting time) = 0.02230
Means followed by different letter (s) in a column are significant at 5% level of probability.

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