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Evaluation of potato genotypes for processing traits in late autumn

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ABSTRACT

The present study was undertaken to evaluate potato genotypes for their suitability for processing when grown under different crop durations, i.e., E_1 (80 days' crop duration), E_2 (100 days' crop duration) and E_3 (120 days' crop duration). Among the three durations studied, E_3 yielded the highest processing-grade yield (q/ha), followed by E_2 and E_1. The crop in E_3 also exhibited high dry-matter content and low levels of reducing sugars compared to that in the other crop durations, which is desirable for processing. Among the cultivars under study, Kufri Badshah, Kufri Anand, Kufri Bahar, Kufri Chipsona-1, Kufri Chipsona-2, Kufri Ashoka and Kufri Jawahar gave the highest total tuber-yield. However, for processing-grade yield, cvs. Kufri Badshah, Kufri Chipsona-1 and Kufri Jawahar yielded significantly better than the mean, but cv. Kufri Chipsona-1 was the one found suitable for processing due to its high dry-matter content (22.07%), while, the other cultivars were found suitable for table purpose alone. Though cv. Kufri Chipsona-1 yielded higher (309.39 q/ha), its performance could not be predicted under various conditions owing to the data on regression coefficient (being less than one), and a significant deviation from regression. Cultivars Kufri Chipsona-1 and Kufri Chipsona-2 were found to be suitable for processing, with high tuber- and processing-grade yield, high dry-matter content, low amount of reducing sugars and phenols in the crop durations E_2 and E_3. Both these cultivars produced chips of acceptable colour in all three crop durations.

Key words: Potato, genotypes, autumn season, processing quality

INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of the most important food crops both in the developing and the developed countries. Potato processing is well advanced in developed countries, but now processing industry in the developing countries is also growing fast. In India, there is an increase in processing activity due to an increase in urban population, preference of the new generation for fast foods, rise in *per capita* income, and increase in the number of working women (preferring ready-to-cook foods) and an expanding tourism (Marwaha, 1997). Processing of potatoes solves the problem of storing large quantities of this commodity during periods of glut. A large number of companies, including multinationals, have stepped into the field of potato processing. The processing industry needs potatoes with high dry matter (over 20%), low amounts of reducing sugars (below 0.25% on fresh weight basis), and low amounts of phenols (Gaur *et al*, 1999).

In the state of Punjab, the main-season crop is grown under short-day conditions beginning in October, and is harvested in January/ February. During crop maturation, the average minimum temperature is 4.5°C, which results in relatively low dry-matter content and high levels of reducing sugars (Ezekiel *et al*, 1999). Days to harvest also affect processing quality in potato, viz., its dry matter content, sugar content, reducing sugars, phenolic compounds, and specific gravity (Marwaha and Sandhu, 2002). Therefore, identifying suitable varieties for late-autumn planting in the North-Western plains will not only ensure supply of fresh potatoes to the processing industry of North India for a longer period, but also minimize transportation charges, and save on the storage cost of tubers (Pandey *et al*, 2003).

MATERIAL AND METHODS

The experimental material comprised ten genetically diverse potato genotypes, viz., Kufri Badshah, Kufri Anand, Kufri Chandramukhi, Kufri Bahar, Kufri Lauvkar, Kufri Chipsona-1, Kufri Chipsona-2, Kufri Ashoka, Kufri Jawahar and Russet Nor x 97-ES-33, obtained from Central Potato Research Institute (CPRI), Shimla. These were multiplied at Vegetable Research Farm of Department of Vegetable

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Science, PAU, Ludhiana. All the ten cultivars were evaluated in Randomized Block Design (RBD), with three replications. Each plot measured 3.2m x 1.2m, and consisted of 16 plants in each row. Seed-sized tubers were planted at row-to-row and plant-to-plant spacing of 60cm and 20cm, respectively. The crop was planted on 16th November 2005. Three experiments were laid out for different crop durations, viz., 80, 100 and 120 days. Various crop durations are symbolized below:

Environment-I (E_1) – Haulm cutting 80 days after planting

Environment-II (E_2)– Haulm cutting 100 days after planting

Environment-III (E_3)– Haulm cutting 120 days after planting

Each crop was harvested at 10-15 days at haulm cutting. The crop was raised following a package of practices for potato recommended by Punjab Agricultural University, Ludhiana. Processing characters like dry-matter content (%), total amount of sugars (Yemm and Willis, 1954), reducing sugars (mg/100g fresh weight) (Nelson, 1944), total amount of phenols (Swain and Hillis, 1959) and polyphenol oxidase chip colour (score), were all studied. Statistical analysis of variance was carried out for Randomized Block Design for each character separately, in each of the three environments (crop duration cycles). Phenotypic stability analysis of genotypes was assessed for their stability of performance over environments, using a model suggested by Eberhart and Russell (1966). The following model was used for describing performance of a variety over a series of environments:

$$Y_{ij} = \mu_i + \beta_i I_j + \delta_{ij}$$

where,

Y_{ij} = Variety Mean of the ith variety at the jth environment (where i=1, 2 …….g, j=1, 2 ……….n)

μi = Overall Mean of the ith genotype over all the environments

β_i = Regression coefficient of ith variety to the varying environments

I_j = Environmental index obtained as the Mean of all genotypes at the jth environment minus the Grand Mean, i.e.,

$$I_j = \frac{Y.}{g} \quad \frac{Y..}{gn}$$

where,

$$\Sigma_j I_j = 0$$

δ_{ij} = Deviation from regression of the ith variety in jth environment

g = Number of genotypes

n = Number of environments

Stability parameters of individual genotypes were calculated as per Eberhart and Russell (1966).

RESULTS AND DISCUSSION

Cultivars Kufri Chipsona-1 (161.47 q/ha), Kufri Chipsona-2 (209.23 q/ha) and Kufri Ashoka (151.03 q/ha) had significantly higher processing-grade yield than the Mean value (124.49 q/ha) in E_1. However, in the case of E_2, cvs. Kufri Badshah (200.70 q/a), Kufri Bahar (169.30 q/ha), Kufri Lauvkar (180.57 q/ha), Kufri Chipsona-1 (174.50 q/ha) and Kufri Chipsona-2 (189.57 q/ha) yielded significantly higher than the Mean (152.85 q/ha). In the third environment (E_3), cvs. Kufri Badshah (325.03 q/ha), Kufri Chipsona-1 (224.50 q/ha) and Kufri Jawahar (224.87 q/ha) gave significantly better yield than the Mean value (196.16 q/ha) (Table 1). Analysis of pooled data revealed that cvs Kufri Badshah and Kufri Chipsona-2 had significantly higher processing-grade yield (215.47 q/ha and 196.02 q/ha, respectively) than the pooled Mean (157.83 q/ha).

In the case of environment E_1, cvs. Kufri Chipsona-1 and Kufri Chipsona-2 showed significantly higher dry-matter content than the Mean value. However, in the case of E_2, cvs. Kufri Anand, Kufri Chipsona-1, Kufri Chipsona-2 and Russet Nor x 97-ES-33 showed significantly higher dry-matter content than the Mean. In E_3, cv. Kufri Chipsona-1 alone had significantly higher dry-matter content than the Mean value. Pooled data analysis indicated that cvs. Kufri Anand, Kufri Chipsona-1, Kufri Chipsona-2 and Russet Nor x 97-ES-33 had significantly higher Mean value than the pooled Mean. Kufri Chipsona-1 had the highest dry-matter (20.69%), followed by Kufri Chipsona-2 (19.93%), Russet Nor x 97-ES-33 (19.83%) and Kufri Anand (19.74%) (Table 2).

Cultivars Kufri Chipsona-1, Kufri Chipsona-2 and Russet Nor x 97-ES-33 had a high Mean dry-matter content, with regression coefficient less than one (0.74, 0.22 and 0.90, respectively) and a non-significant deviation from regression, showing their suitability for cultivation under diverse environmental conditions. Studies of Patel *et al* (2003) and Pandey *et al* (2005) also support the above findings.

In environments E_1 and E_2, cvs. Kufri Chandramukhi, Kufri Lauvkar, Kufri Chipsona-1, Kufri Chipsona-2 and

Table 1. Mean $(\bar{X}i)$, regression coefficient (bi) and deviation from regression (S^2di) for processing-grade yield (q/ha) in potato during the autumn season 2005-2006

Sl. No.	Genotype	E_1	E_2	E_3	Overall Mean $(\bar{X}i)$	bi	S^2di
1.	Kufri Badshah	120.67	200.70	325.03	215.47	2.85	0.55
2.	Kufri Anand	90.30	147.47	212.70	150.16	1.69	50.02
3.	Kufri Chandramukhi	93.78	48.57	87.68	76.67	0.00	1203.67*
4.	Kufri Bahar	133.68	169.30	197.93	166.97	0.88	68.23
5.	Kufri Lauvkar	105.03	180.57	140.60	142.07	0.38	2482.04*
6.	Kufri Chipsona-1	161.47	174.50	224.50	186.82	0.90	93.30
7.	Kufri Chipsona-2	209.23	189.57	189.26	196.02	-0.26	90.91
8.	Kufri Ashoka	151.03	153.63	219.30	174.66	1.00	391.86*
9.	Kufri Jawahar	69.45	164.07	224.87	152.80	2.11	720.22*
10.	Russet Nor x 97-ES-33	110.27	100.20	139.73	116.73	0.45	310.28*
Mean		124.49	152.85	196.16	157.83		
CD (5%)		16.11	14.64	23.73	34.52	SE of bi = 0.45	
CV		5.95	5.40	8.76			

*Significant at 1%

Table 2. Mean $(\bar{X}i)$, regression coefficient (bi) and deviation from regression (S^2di) for dry matter content (%) in potato during the autumn season 2005-2006

Sl. No.	Genotype	E_1	E_2	E_3	Overall Mean $(\bar{X}i)$	bi	S^2di
1.	Kufri Badshah	15.21	17.49	18.96	17.22	1.04	0.03
2.	Kufri Anand	18.58	20.29	20.36	19.74	1.04	0.09
3.	Kufri Chandramukhi	16.04	18.54	21.27	18.62	1.44	0.10
4.	Kufri Bahar	16.25	19.04	18.98	18.09	0.78	1.08*
5.	Kufri Lauvkar	16.81	17.02	18.72	1752	0.51	0.47
6.	Kufri Chipsona-1	19.37	20.63	22.07	20.69	0.74	0.04
7.	Kufri Chipsona-2	19.17	20.74	19.87	19.93	0.22	0.93
8.	Kufri Ashoka	14.44	17.10	21.29	17.61	1.87	0.85
9.	Kufri Jawahar	14.53	17.44	19.87	17.28	1.47	0.00
10.	Russet Nor x 97-ES-33	18.04	20.19	21.26	19.83	0.90	0.09
Mean		16.84	18.85	20.26	18.65		
CD (5%)		1.86	1.32	1.10	0.90	SE of bi = 0.24	
CV		5.78	4.14	3.41			

*Significant at 5%

Table 3. Mean $(\bar{X}i)$, regression coefficient (bi) and deviation from regression (S^2di) for total amount of sugars (mg/100g fresh weight) in potato during the autumn season 2005-2006

Sl. No.	Genotype	E_1	E_2	E_3	Overall Mean $(\bar{X}i)$	bi	S^2di
1.	Kufri Badshah	975.67	816.33	571.67	787.89	1.59	9435.81*
2.	Kufri Anand	692.67	477.00	369.33	513.00	1.37	56.93
3.	Kufri Chandramukhi	494.67	371.33	326.00	397.33	0.72	21.95
4.	Kufri Bahar	736.67	467.00	356.67	520.11	1.62	16.19
5.	Kufri Lauvkar	487.67	334.00	293.00	371.56	0.85	208.03*
6.	Kufri Chipsona-1	347.67	288.67	268.67	301.67	0.34	10.07
7.	Kufri Chipsona-2	304.67	270.00	232.33	269.00	0.29	156.36*
8.	Kufri Ashoka	748.33	483.33	432.00	554.56	1.39	1268.33*
9.	Kufri Jawahar	668.33	405.67	375.67	483.22	1.31	2197.54*
10.	Russet Nor x 97-ES-33	511.00	416.67	390.67	439.44	0.52	70.49
Mean		596.73	433.00	361.60	463.78		
CD (5%)		16.57	12.10	12.39	54.43	SE of bi = 25.92	
CV		2.08	1.52	1.56			

*Significant at 1%

Russet Nor x 97-ES-33, had significantly less amount of total sugars than the Mean. Cultivars Kufri Anand, Kufri Chandramukhi, Kufri Lauvkar, Kufri Chipsona-1 and Kufri Chipsona-2 had significantly lower amount of total sugars than the Mean in E_3 (Table 3). In pooled analysis of data, four cultivars, viz., Kufri Chandramukhi, Kufri Lauvkar, Kufri Chipsona-1 and Kufri Chipsona-2, had significantly lower Mean of total level of sugars than did the pooled Mean. 'Kufri Chipsona-2' had the lowest mean of total level of sugars (269.00mg), followed by Kufri Chipsona-1 (301.67mg), Kufri Lauvkar (371.56mg) and Kufri Chandramukhi (397.33mg) per 100g on fresh-weight basis. Cultivars Kufri Chandramukhi, Kufri Chipsona-1, Kufri Chipsona-2 and Russet Nor x 97-ES-33 had lower Mean values for total amount of sugars as less than one regression coefficient (0.72, 0.34, 0.29 and 0.52, respectively), and non-significant deviation from regression, indicating that performance of these cultivars could not be predicted under unfavourable environments.

In this study, none of the cultivars showed regression coefficient equal to one or significant deviation from regression, indicating that no cultivar had average stability for this trait in all the three environments studied. The high amount of total sugars in environments E_1 and E_2 in our investigation could be attributed to low temperature (4.4°C), along with occurrence of frost during the vegetative phase and tuber development. Studies by Uppal *et al* (2003) also indicated that cvs. Kufri Chipsona-1and Kufri Chipsona-2 contained the lowest amount of total sugars (362 and 367mg/ 100g fresh weight, respectively).

Cultivars Kufri Lauvkar, Kufri Chipsona-1, Kufri Chipsona-2 and Russet Nor x 97-ES-33 had lesser amount of reducing sugars than the Mean in all the three environments (Table 4). Persual of pooled data also showed that cvs. Kufri Lauvkar, Kufri Chipsona-1, Kufri Chipsona-2 and Russet Nor x 97-ES-33 had significantly lower quantities of reducing sugars than the pooled Mean. 'Kufri Chipsona-1' had the lowest amount of reducing sugars (75.74mg/100g fresh weight), followed by 'Kufri Chipsona-2' (81.94mg/100g fresh weight), 'Russet Nor x 97-ES-33' (165.88mg/100g fresh weight) and 'Kufri Lauvkar' (202.90mg/100g fresh weight). Kumar *et al,* (2003) also reported reducing sugars to vary from season to season, and cool weather (1-5°C) led to an increase in sugar levels. This variation could be attributed to variation in crop durations under different environments. Cultivars Kufri Chipsona-1 and Kufri Lauvkar showed the content of reducing sugars within permissible limits, regression coefficient of less than one, and a non-significant deviation from regression, indicating suitability of these genotypes for cultivation under unfavorable environmental conditions. Gaur *et al* (1999) reported that potatoes grown in North-Western plains contained relatively low dry-matter and higher amounts of reducing sugars (which were attributed to the comparatively low temperature prevalent during crop maturation).

'Kufri Chipsona-1' had significantly less amounts of total phenols than the Mean value under environment E_1. However, in the case of E_2, cvs. Kufri Lauvkar and Kufri Chipsona-1 showed significantly lower amounts of total phenols than the Mean value. In the case of E_3, cvs. Kufri Anand, Kufri Lauvkar, Kufri Chipsona-2 and Kufri Ashoka

Table 4. Mean ($\bar{X}i$), regression coefficient (bi) and deviation from regression (S^2di) for levels of reducing sugars (mg/100g fresh weight) in potato during the autumn season 2005-2006

Sl. No.	Genotype	E_1	E_2	E_3	Overall Mean ($\bar{X}i$)	bi	S^2di
1.	Kufri Badshah	456.47	433.22	403.48	431.05	0.52	263.99
2.	Kufri Anand	340.54	234.52	238.95	271.34	1.29	240.20
3.	Kufri Chandramukhi	341.08	230.29	212.57	261.31	1.52	3.61
4.	Kufri Bahar	473.99	307.78	312.98	364.92	2.03	537.60*
5.	Kufri Lauvkar	211.36	202.72	194.62	202.90	0.17	17.22
6.	Kufri Chipsona-1	103.22	77.76	46.24	75.74	0.56	293.18
7.	Kufri Chipsona-2	102.08	94.92	48.81	81.94	0.45	820.55**
8.	Kufri Ashoka	320.86	282.79	308.91	304.19	0.27	451.78*
9.	Kufri Jawahar	402.15	298.87	267.36	322.79	1.53	61.12
10.	Russet Nor x 97-ES-33	253.82	124.50	119.33	165.88	1.65	147.58
Mean		300.56	228.74	215.35	248.21		
CD (5%)		30.60	24.99	21.08	24.99	SE of bi = 0.26	
CV		7.19	5.87	4.95			

*Significant at 5%; **Significant at 1%

showed significantly less amounts of total phenols than the Mean value (Table 5). From pooled analysis, cv. Kufri Lauvkar alone had a lower Mean of total phenols (37.56mg/ 100g fresh weight) than the pooled Mean. Though some of the cultivars showed a regression coefficient close to one (Kufri Anand, Kufri Ashoka and Kufri Jawahar), deviation from regression in their case was significant, thereby indicating poor stability of these cultivars for this trait. However, these values are higher than those reported by Marwaha (1999) in hybrids MP/90-94 (25.6mg), MP/91-G (27.1mg) and MP/90-83 (30.1mg) on per 100g fresh weight basis.

In the environment E_1, cv. Kufri Anand (0.06) alone had significantly less activity of polyphenol oxidase than the Mean value (0.08). In the case of E_2, cvs. Kufri Badshah and Kufri Chipsona-2 had significantly less value for polyphenol oxidase activity than the Mean value (0.08). However, none of the cultivars showed significantly less value of polyphenol oxidase than the Mean value in environment E_3 (Table 6). Analysis of pooled data indicated that cv. Kufri Chipsona-2 alone had on overall Mean (0.06) of polyphenol oxidase similar to the pooled Mean (0.06). However, Uppal (1999) reported that polyphenol oxidase activity was the highest in tubers of cv. Kufri Sutlej, and lowest in cv. Kufri Jawahar.

In the environment E_1, cvs. Kufri Chipsona-1 and Kufri Chipsona-2 produced chips of acceptable colour (each having a colour score of 2). In environment E_2, cvs. Kufri Chipsona-1, Kufri Chipsona-2 and Russet Nor x 97-ES-33 produced chips of acceptable colour (2.00, 2.00 and 2.67 score, respectively). However, cvs. Kufri Lauvkar, Kufri Chipsona-1, Kufri Chipsona-2 and Russet Nor x 97-ES-33

Table 5. Mean ($\bar{X}i$), regression coefficient (bi) and deviation from regression (S^2di) for total amount of phenols (mg/100g fresh weight) in potato during the autumn season 2005-2006

Sl. No.	Genotype	E_1	E_2	E_3	Overall Mean ($\bar{X}i$)	bi	S^2di
1.	Kufri Badshah	64.00	39.67	35.00	46.22	1.12	0.86
2.	Kufri Anand	59.33	44.33	27.67	43.78	1.07	62.77**
3.	Kufri Chandramukhi	58.33	38.00	37.33	44.56	0.85	7.65*
4.	Kufri Bahar	74.00	50.00	40.33	54.78	1.25	4.86
5.	Kufri Lauvkar	56.33	26.33	30.00	37.56	1.13	48.22**
6.	Kufri Chipsona-1	54.33	34.33	38.00	42.22	0.72	28.67**
7.	Kufri Chipsona-2	59.67	38.33	29.00	42.33	1.13	5.84*
8.	Kufri Ashoka	59.00	41.67	28.33	43.00	1.07	30.31**
9.	Kufri Jawahar	57.67	40.33	33.33	43.78	0.90	2.57
10.	Russet Nor x 97-ES-33	56.00	36.67	37.67	43.44	0.76	13.22**
Mean		59.86	38.96	33.66	44.16		
CD (5%)		4.00	3.00	2.67	6.72	SE of bi = 0.23	
CV		5.28	3.97	3.53			

*Significant at 5%; **Significant at 1%

Table 6. Mean ($\bar{X}i$), regression coefficient (bi) and deviation from regression (S^2di) for polyphenol oxidase (IU) in potato during autumn season, 2005-06

Sl. No.	Genotype	E_1	E_2	E_3	Overall Mean ($\bar{X}i$)	bi	S^2di
1.	Kufri Badshah	0.08	0.04	0.05	0.06	1.47	0.00
2.	Kufri Anand	0.06	0.05	0.07	0.06	-0.22	0.00
3.	Kufri Chandramukhi	0.07	0.06	0.05	0.06	0.96	0.00
4.	Kufri Bahar	0.09	0.06	0.06	0.07	1.13	0.00
5.	Kufri Lauvkar	0.09	0.08	0.05	0.07	1.43	0.00
6.	Kufri Chipsona-1	0.09	0.08	0.06	0.08	0.92	0.00
7.	Kufri Chipsona-2	0.08	0.04	0.05	0.06	1.32	0.00
8.	Kufri Ashoka	0.09	0.08	0.05	0.07	1.58	0.00
9.	Kufri Jawahar	0.08	0.09	0.05	0.07	1.39	0.00
10.	Russet Nor x 97-ES-33	0.08	0.07	0.07	0.07	0.02	0.00
Mean		0.08	0.06	0.05	0.06		
CD (5%)		0.02	0.02	0.01	0.01	SE of bi = 0.67	
CV		19.16	27.53	36.70			

*Significant at 5%; **Significant at 1%

Table 7. Mean ($\bar{X}i$), regression coefficient (bi) and deviation from regression (S^2di) for chip colour (score) in potato during the autumn season 2005-2006

Sl. No.	Genotype	E_1	E_2	E_3	Overall Mean ($\bar{X}i$)	bi	S^2di
1.	Kufri Badshah	6.33	5.67	5.00	5.67	1.25	0.00
2.	Kufri Anand	5.67	4.67	4.33	4.89	1.25	0.07
3.	Kufri Chandramukhi	5.33	4.67	3.67	4.56	1.56	0.02
4.	Kufri Bahar	5.33	5.67	4.67	5.22	0.62	0.30
5.	Kufri Lauvkar	4.67	3.67	3.00	3.78	1.56	0.02
6.	Kufri Chipsona-1	2.00	2.00	1.33	1.78	0.62	0.07
7.	Kufri Chipsona-2	2.00	2.00	1.33	1.78	0.62	0.07
8.	Kufri Ashoka	5.33	5.33	5.67	5.44	-0.31	0.02
9.	Kufri Jawahar	5.33	4.67	4.00	4.67	1.25	0.00
10.	Russet Nor x 97-ES-33	4.33	2.67	2.67	3.22	1.56	0.46*
Mean		4.30	4.10	3.57	4.10		
CD (5%)		1.81	0.92	1.07	0.48	SE of bi = 0.43	
CV		11.59	13.02	11.77			

*Significant at 5%

produced chips of acceptable colour (score ≤ 3.0) in environment E_3 (Table 7). Potatoes grown in a cool climate, particularly in areas where night-temperature drops below 10°C during the last month before harvest, are found not suitable for processing (Ezekiel *et al,* 1999). Pooled data analysis indicated that cvs. Kufri Chipsona-1 and Kufri Chipsona-2 produced chips of acceptable colour. 'Kufri Chipsona-1' and 'Kufri Chipsona-2' produced chips of excellent quality and light colour (score of 1.78 each). Pandey *et al* (2005) reported that in a late-planted crop at Modipuram, acceptable quality chips were produced only in cv. Kufri Chipsona-1. This cultivar produced light-coloured chips at all the stages of harvest and locations in North-Western and West-Central Indian plains (Pandey *et al,* 2005).

Among the three environments studied, 120 days' crop duration (E_3) yielded the highest total tuber-yield (q/ha) and processing-grade yield (q/ha), followed by E_2 (100 days' crop duration) and E_1 (80 days' crop duration) (Table 1). Besides total tuber-yield, most genotypes in group E_3 exhibited high dry-matter content and low levels of reducing sugars, compared to that in the other environments, and, these are desirable attributes for processing. Though in the environment E_1, cv. Kufri Ashoka yielded significantly higher (151.03 q/ha) than Mean, it had low dry-matter content. Therefore, this was unsuitable for processing purposes, but was suitable for table-purpose. In E_2, cv. Kufri Chipsona-1 and Kufri Chipsona-2 had high yield, high dry-matter content and low amounts of reducing sugars. Therefore, these cultivars are suitable for processing. In the environment E_3, cvs. Kufri Chipsona-1 and Kufri Chipsona-2 were found to have high tuber-yield, high dry-matter content, low levels of reducing sugars, and low amounts of total phenols. Also, both of these cultivars produced chips of acceptable colour in all the three environments. The potential of cvs. Kufri Chipsona-1 and Kufri Chipsona-2 is not fully exploited due to occurrence of frost at the vegetative stage of the crop. Kumar *et al* (2004) documented that 120 days' crop duration was most suitable for Kufri Chipsona-1 and Kufri Chipsona-2 in the spring season crop. From stability analysis data, it is concluded that cv. Kufri Chipsona-2 was stable for total tuber-yield in all the three environments. Therefore, cv. Kufri Chipsona-2 is recommended for cultivation for all the three crop durations to produce potatoes for the processing industry.

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