



AGRO-MORPHOLOGICAL AND QUALITY CHARACTERIZATION OF POTATO (*SOLANUM TUBEROSUM* L.) GERMPLASM

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Abstract

Characterization consists of recording of those characters, which are highly heritable can be easily seen by the open eyes and are expressed in all environments. Characterization of accessions provides the information on morphological and agronomical aspects of the material, which is essential for gene bank management. The present studies were carried out to characterize advance generation clonal bulk population of potato germplasm from IGKV, Raipur (C.G.), India. These germplasm were characterized on the basis of anthocyanin pigmentation, plant habit, fruiting behavior, leaf pubescence and tuber peel, shape and depth of eyes. A great amount of variation was recorded for ten agro-morphological & four quality traits while most of clones were found with green stem colour, semi erect and branching growth habit, angular stem cross section, leaves with glabrescent & pubescent abaxial and adaxial leaf pubescence, green with white spot berry colour, white flower colour, non/ rare fruiting behaviour, tubers with rough peel, round shape, whitish cream colour and medium deep eyes. Single plant selection was made from these populations based on different agronomic characteristics and yield potential. These results have an important implication for potato germplasm characterization, improvement, agro-morphological evaluation and conservation.

Key words : Potato (*Solanum tuberosum* L.), agro-morphological, agricultural production, germplasm, genetic variation.

Introduction

Resource-poor farmers, a large number of whom are women, produce as much as 20 percent of the world's food, and they may well hold the key to increasing biological and cultural diversity. For in their struggle simply to survive - and produce - on poor soils with limited resources, small farmers continue to allow plant varieties to evolve. The result is that these farmers have become curators of diversity, maintaining the genetic variation that is essential to the continued evolution and adaptation of plant genotypes and all agriculture research activities are depend on diversity of genotypes.

Potato is consumed by over billions of people across the Globe of which half is used in the developing countries. In 1961, potato produced in total area in developing countries accumulated for 10.5 per cent of the total world output. Today, developing countries produce about 47.2 per cent of potato in the world. Potato being a wholesome food is one of the world's major non-cereal crops that changed history and is now grown about 150 countries. The germplasm of any crop are an important source of raw material for breeders and still the backbone of

agricultural production (Afuape *et al.*, 2011). Systematic study and characterization of such germplasm is not only important for utilizing the appropriate attribute based donors, but also essential in the present era for protecting the unique germplasm of crops (Bernal *et al.*, 2006 and Rekha *et al.*, 2014). Thus, there is a need to collect, exploit, and evaluate the untapped germplasm. Also, the characterization and conservation of potato germplasm are essential for both safeguarding and the future use of the existing genetic resources of potato. In this context, an attempt was made to characterize a set of potato germplasm for different agro-morphological and quality traits and identify the variability available in the collection.

Materials and Methods

The present study was undertaken at Horticultural Research Farm, Department of Genetics and Plant Breeding, Indira Gandhi Krishi Vishwavidyalaya, Raipur, (C.G.), India. The experimental material was grown under two experiments. Experiment I (18 clonal bulks) and (ii) Experiment II (18 clonal bulks) in RBD with three replications. The crop was raised with recommended

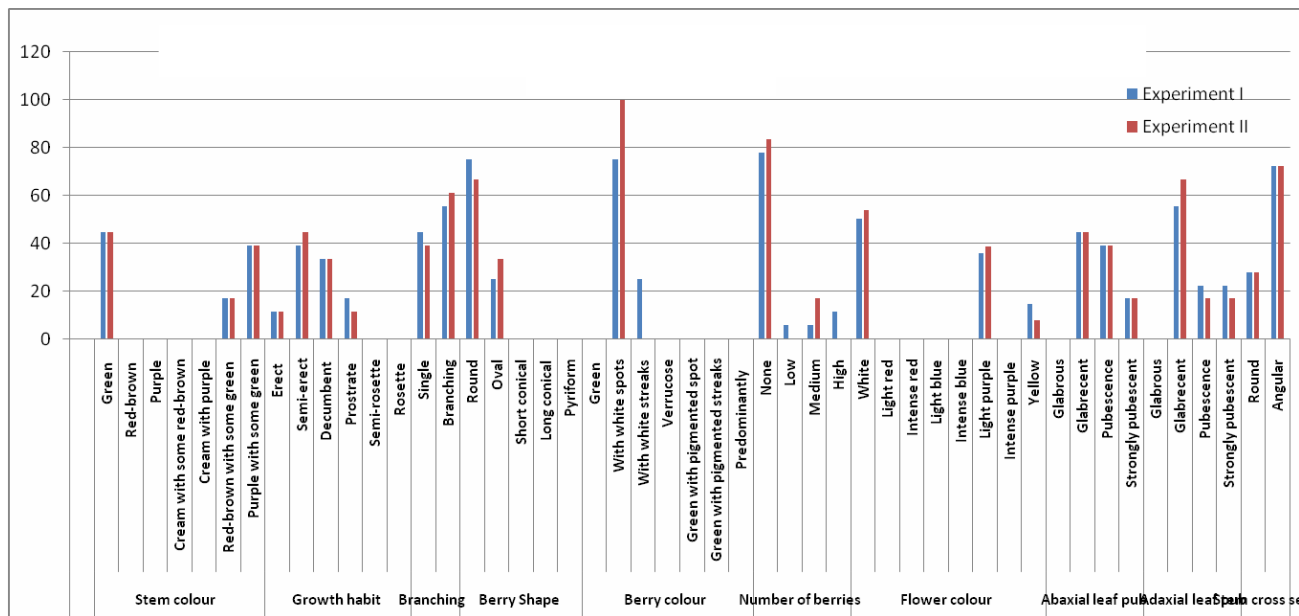


Fig. 1 : Frequency distribution for morphological characters in clonal bulks of potato in Experiment - I & II.

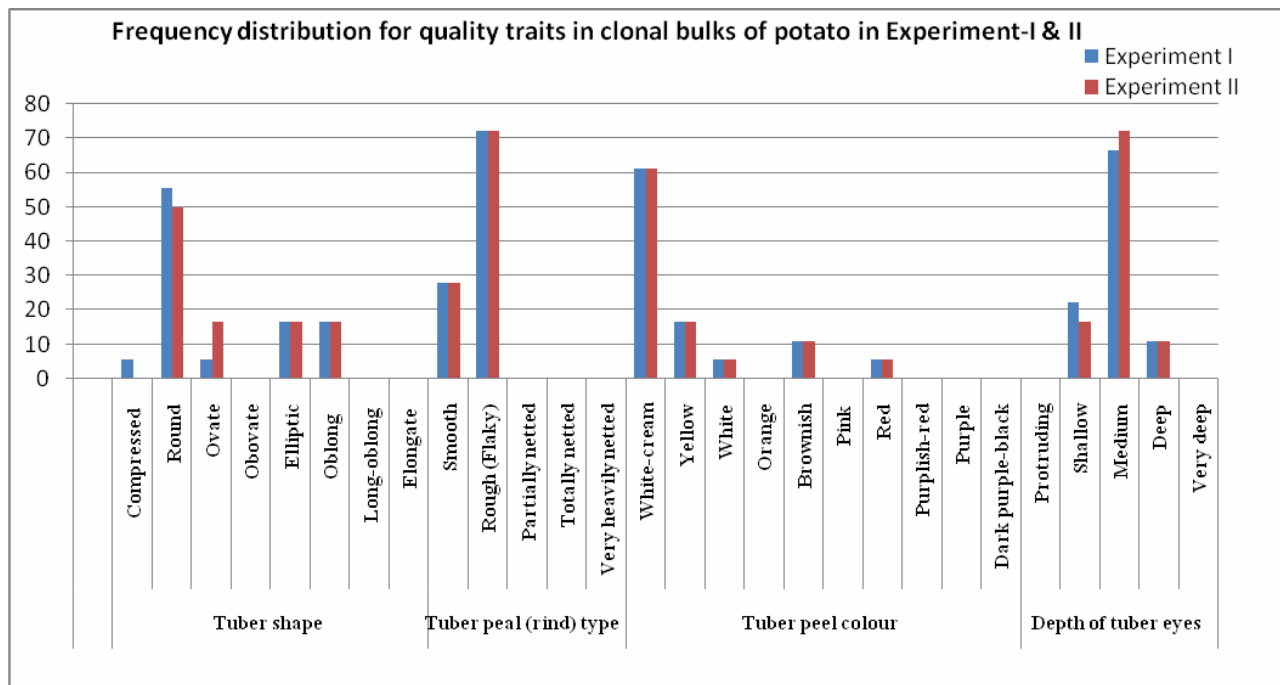


Fig. 2 : Frequency distribution for quality traits in clonal bulks of potato in Experiment - I & II.

cultural practices. For morphological characterization of advanced clones of potato IPGRI, Rome, Italy descriptors were used (CIP/AVRDC/IBPGR, 1991 and Huaman *et al.*, 2000). Observations were recorded for 10 morphological descriptors *viz.*, 1. Stem colour at 45 days after planting; 2. Growth habit type at 45 days after planting; 3. Branching habit at 45 days after planting; 4. Berry shape at maturity; 5. Berry colour; 6. Number of berries per plant; 7. Flower colour; 8. Abaxial leaf pubescence at 45 days after planting; 9. Adaxial leaf

pubescence at 45 days after planting; 10. Stem cross section at 45 days after planting. Four quality traits were also recorded such as 1. Tuber shape; 2. Tuber peel (rind) type; 3. Tuber peel colour; 4. Depth of tuber eyes.

Results and Discussion

Frequency distribution of morphological & quality traits of potato in Experiment- I & II

Morphological characters (table 1, fig. 1)

Frequency distribution for ten morphological

Fig. 1 : Frequency distribution for morphological characters in clonal bulks of potato in Experiment - I & II.

S. no.	Characters	Colour/ Pattern/ Type	Experiment I		Experiment II	
			Frequency	Per cent	Frequency	Per cent
1.	Stem colour	Green	8	44.4	8	44.4
		Red-brown	-	0.0	-	0.0
		Purple	-	0.0	-	0.0
		Cream with some red-brown	-	0.0	-	0.0
		Cream with purple	-	0.0	-	0.0
		Red-brown with some green	3	16.7	3	16.7
		Purple with some green	7	38.9	7	38.9
2.	Growth habit type	Erect	2	11.1	2	11.1
		Semi-erect	7	38.9	8	44.4
		Decumbent	6	33.3	6	33.3
		Prostrate	3	16.7	2	11.1
		Semi-rosette	-	0.0	-	0.0
		Rosette	-	0.0	-	0.0
3.	Branching habit	Single	8	44.4	7	38.9
		Branching	10	55.5	11	61.1
4.	Berry Shape	Round	3	75.0	2	66.7
		Oval	1	25.0	1	33.3
		Short conical	-	0.0	-	0.0
		Long conical	-	0.0	-	0.0
		Pyriiform	-	0.0	-	0.0
5.	Berry colour	Green	-	0.0	-	0.0
		With white spots	3	75.0	3	100
		With white streaks	1	25.0	-	0.0
		Verrucose	-	0.0	-	0.0
		Green with pigmented spot	-	0.0	-	0.0
		Green with pigmented streaks	-	0.0	-	0.0
		Predominantly	-	0.0	-	0.0
6.	Number of berries	None	14	77.8	15	83.3
		Low	1	5.5	-	0.0
		Medium	1	5.5	3	16.7
		High	2	11.1	-	0.0
7.	Flower colour	White	7	50.0	7	53.8
		Light red	-	0.0	-	0.0
		Intense red	-	0.0	-	0.0
		Light blue	-	0.0	-	0.0
		Intense blue	-	0.0	-	0.0
		Light purple	5	35.7	5	38.5
		Intense purple	-	0.0	-	0.0
		Yellow	2	14.3	1	7.7
8.	Abaxial leaf pubescence	Glabrous	-	0.0	-	0.0
		Glabrecent	8	44.4	8	44.4
		Pubescence	7	38.9	7	38.9
		Strongly pubescent	3	16.7	3	16.7
9.	Adaxial leaf pubescence	Glabrous	-	0.0	-	0.0
		Glabrecent	10	55.5	12	66.6
		Pubescence	4	22.2	3	16.7
		Strongly pubescent	4	22.2	3	16.7
10.	Stem cross section	Round	5	27.8	5	27.8
		Angular	13	72.2	13	72.2

Table 2 : Frequency distribution for quality traits in clonal bulks of potato in Experiment-I & II.

S. no	Characters	Colour/ Pattern/ Type	Experiment I		Experiment II	
			Frequency	Per cent	Frequency	Per cent
1.	Tuber shape	Compressed	1	5.5	-	0.0
		Round	10	55.5	9	50.0
		Ovate	1	5.5	3	16.7
		Obovate	-	0.0	-	0.0
		Elliptic	3	16.7	3	16.7
		Oblong	3	16.7	3	16.7
		Long-oblong	-	0.0	-	0.0
		Elongate	-	0.0	-	0.0
2.	Tuber peel (rind) type	Smooth	5	27.8	5	27.8
		Rough (Flaky)	13	72.2	13	72.2
		Partially netted	-	0.0	-	0.0
		Totally netted	-	0.0	-	0.0
		Very heavily netted	-	0.0	-	0.0
3.	Tuber peel colour	White-cream	11	61.1	11	61.1
		Yellow	3	16.7	3	16.7
		White	1	5.5	1	5.5
		Orange	-	0.0	-	0.0
		Brownish	2	11.1	2	11.1
		Pink	-	0.0	-	0.0
		Red	1	5.5	1	5.5
		Purplish-red	-	0.0	-	0.0
		Purple	-	0.0	-	0.0
		Dark purple-black	-	0.0	-	0.0
		4.	Depth of tuber eyes	Protruding	-	0.0
Shallow	4			22.2	3	16.7
Medium	12			66.7	13	72.2
Deep	2			11.1	2	11.1
Very deep	-			0.0	-	0.0

characters were recorded for clonal bulks of potato of both experiments. In both experiments, majority of genotypes are found possessing green stem colour (44.4%) followed by purple mixed with green (38.9%) and red-brown mixed with green (16.7%). Regarding growth habit, 38.9% (in experiment I) & 44.4% (in experiment II) genotypes showed semi erect plant habit followed by decumbent (33.3%) and the lowest (11.1%) in erect habit type (Akhtar, 2000 and Dobrovol, 1990). Most of genotypes belonging to branching habit (55.5% in experiment I) & (61.1% in experiment II) except eight genotypes *viz.*, CIP 302024, CIP 304012, CIP 304102, CIP 398068, Kufri Jawahar, Kufri Ashoka, Kufri Pukhraj and Kufri Surya, which showed single branching habit

(44.4%) (Santini *et al.*, 2000 and Kaledzi *et al.*, 2010). Similarly, in leaf pubescence seven genotypes *viz.* CIP 398203, CIP 304102, CIP 398181, CIP 304124, CIP 398068, Kufri Ashoka, Kufri Pukhraj and Kufri Surya were under glabrecent abaxial leaf pubescence (44.4%), seven were recorded with pubescence (38.9%) and three genotypes *viz.* CIP 304146, CIP 304014 and CIP 303139 recorded with strongly abaxial leaf pubescence (16.7%) (Sharma, 2000). Most of the genotypes were recorded with glabrecent adaxial leaf pubescence (55.5% in experiment I) & (66.6% in experiment II) followed by pubescence (22.2% in experiment I & 16.7% in experiment II) and strongly pubescence (22.2% in experiment I & 16.7% in experiment II), stem cross section

was categorized as round & angular. Angular stem cross section was observed (72.2%), followed by round in 13 genotypes followed by round stem cross section (27.8%). It was notable here that majority of the genotypes were not bearing fruits (berry). Whereas, three genotypes *viz.*, CIP 304012, CIP 304102 and Kufri Jawahar showed round (75.0% in experiment I & 66.7% in experiment II) and one genotype (CIP 398201) recorded with oval berry shape. Green with white spot berry colour was found in most of all the genotypes except one (CIP 304012) which showed green with white streaks and white flower colour (50.0% in experiment I & 53.8% in experiment II) (Gopal *et al.*, 2007).

Frequency distribution for quality traits in clonal bulks of potato in Experiment-I & II

A. Quality traits (table 2, fig. 2)

In clonal bulks, rough tuber peel type (72.2%), round tuber shape (55.5% in experiment I & 50.0% in experiment II) and whitish-cream tuber colour (61.1%) with medium eye depth (66.7% in experiment I & 72.2% in experiment II) was observed in most of genotypes.

In both experiments, most of clones showed green stem colour, semi erect branching growth habit, leaves with glabrecent abaxial and adaxial pubescent, angular stem cross section and non/ rare fruiting behavior in frequency distribution for morphological characters.

Frequency distribution for quality traits in clonal bulks of potato in both experiments showed tubers with rough peel, round shape, whitish cream colour and medium deep eyes.

Conclusion

- In present study, a wide range of variation was observed in clonal bulks of potato in both experiments I & II for morphological & quality traits.
- These results have an important implication for potato germplasm characterization, improvement, agro-morphological evaluation and conservation.
- The germplasm represents a valuable source of genetic diversity that is expected to be highly useful for future breeding programs.
- The success in genetic improvement of the crop, however, depends on the availability of genetic resources and their diversity.

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