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RESEARCH ARTICLE

OLEORESIN YIELD AND COLOUR VALUE OF VARIOUS CHILLI GENOTYPES IN BLACK SOIL UNDER VIDHARBHA REGION OF MAHARASHTRA

[1,*]Puttapalli Raja Sekhar and [2]Bhoyar, S. M.

[1]Department of Soil Science and Agricultural Chemistry, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal, India

[2]Department of Soil Science and Agrilcultural Chemistry, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

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ABSTRACT

Oleoresin is a viscous liquid, possessing aroma and flavor, extracted from red chilli fruits is preferred against ground chillies in view of its natural anti-oxidant, long shelf life under ideal conditions and less storage space. In food and beverage industries, chillies have acquired great importance in the form of oleoresins which permit uniform distribution of colour to foodstuffs and characteristic flavor. In the pursuit of promising oleoresin yield, a field experiment was conducted in Black soil of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during *Kharif*-2013-14 with the consideration of twenty chilli genotypes as twenty treatments in randomized block design. All the treatments fertilized with common recommended dose of fertilizer (150:50:50) and package of practices. Quality parameters viz. oleoresin and colour value in chilli fruits was increased with maturity of the fruits Agnirekha recorded significantly highest oleoresin content 13.95 % and 19.34 % in green and red chilli fruits respectively. Nonetheless G-5 and G-4 genotypes from guntur recorded highest oleoresin yield 14.90 kg ha^{-1} and 150.56 kg ha^{-1} in green and red chilli respectively. Highest colour value of green (86.05 ASTA Units) and red (274.48 ASTA Units) fruits were observed in chilli genotype GCL 5-4 and G-5, respectively. However, genotype G-5 performed well with respect to both oleoresin yield and colour value and suitable for black soil under semi-arid climatic condition. Furthermore, after harvest mean fertility status of soil (N 0.030 %, P 16.58 kg ha^{-1} and K 229.86 kg ha^{-1}) was decline over initial status (N 0.031 %, P17.27 kg ha^{-1} and K 288.85 kg ha^{-1}) to meet out its nutritional requirement.

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INTRODUCTION

Capsanthin and capsorubin pigments collectively known as oleoresin (Bosland and Votava, 2000). It is a viscous liquid, possessing aroma and flavour, is also extracted from finely ground chilli powder and considered to be among the best substitute of synthetic colour used in food and cosmetic industries (Kumar *et al*., 2006). It is used in medicine internally as a powerful stimulant and carminative and externally as a counter irritant in the treatment of diseases such as rheumatism. Oleoresin requires less storage space and consist natural anti-oxidant, long shelf life under ideal conditions. In food and beverage industries, chillies have acquired great importance in the form of oleoresins which permit uniform distribution of colour to food stuffs and characteristic flavour. Indian chillies are considered to be world famous for its colour and pungency. The demand for natural pigments of chillies is increasing as it is extensively used in organic food colours and offer good potential for export. The attractive red colour plays an important role in assessing the quality of chillies. The principle colouring matter is the carotenoid pigment viz., capsanthin and capsorubins constituting about 60-70 per cent of the total pigments. The contents of capsanthin and capsorubin incease proportionally with advanced stages of ripening with capsanthin being the more stable (Bosland, 1996). Capsanthin and capsorubin can improve the cytotoxic action of anticancer chemotherapy and considered to be potential of carotenoids as possible resistance modifiers in cancer chemotherapy (Maoka *et al.,* 2001). The black or dark colours of soils as indicators of fertile soils are reflections of the high amounts of organic matter content in the soils, hence high availability of plant nutrients, high capacity to retain nutrients in exchangeable forms, high moisture retention and storage and source of energy and carbon for soil micro-organisms (Stevenson, 1982; Brady and Weil, 1996). In

Corresponding author: Puttapalli Raja Sekhar,
Department of Soil Science and Agricultural Chemistry, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal, India

view of the above, this study was undertaken, to evaluate the different chilli genotypes for oleoresin yield and colour value in black soil under semi-arid condition of Vidharbha region in Maharashtra state at Dr. Panjabrao Deshmukh Krishi Vidhyapeeth, Akola.

METHODS AND MATERIALS

A field experiment on different promising chilli genotypes was conducted during the kharif, 2013-14 with the consideration of twenty chilli genotypes as twenty treatments to evaluate oleoresin content and colour value under semi-arid condition of Vidharbha region in Maharashtra state at Dr. PDKV, Akola. Amongst 20 chilli genotypes under study, 14 were the Dr. PDKV, Akola genotypes (i.e. T_7 to T_{20}) and rest of six were the popular promising genotypes from various sources i.e. IARI New Delhi, Guntur, Gujarat, MPKV Rahuri and Pvt. Company genotype. The experiment was laid out in randomized block design in three replications with twenty treatments (i.e. chilli genotypes). The soil of experimental site was medium to deep black having clay content 51.22 per cent classified it in clay texture. The initial analysis indicated that, soils are slightly alkaline in reaction having electrical conductivity 0.56 ds m^{-1} and medium in organic carbon content (5.0 g kg^{-1}). As regards of fertility status the soils are very low in total nitrogen (0.031%) which reflects on very low content in available nitrogen (132.16 kg ha^{-1}) and also low in available phosphorus (17.22 kg ha^{-1}) however moderately high in available potash (288.85 kg ha^{-1}). Healthy and uniform six week old chilli seedlings were transplanted in main field with a spacing of 60 x 45 cm. Common cultural practices and recommended doses of fertilizers was given to all chilli genotypes during land preparation (FYM @ 25 t ha^{-1} and N:P:K 150:50:50 kg ha^{-1}) Usually green chillies are being sold in a market as fresh fruits may not be dried due to lack of processing facilities in rainy season. Hence in the study attempt have been made to dry the green and red chilli by using mechanized controlled Dr. PDKV technology to obtained dry chillies without losing its colour which may be further either utilized for domestic/household consumption or can go for industrial utilization for extraction of natural green and red colour, oleoresin and alkaloid capsaicin. The drying time varied significantly from 24 hours to 48 hours depending upon whether the chilli is thin pericarp type (thin walled chilli) or thick pericarp (thick walled) type genotype.

Drying air temperature was maintained in the range of 55-60 ^{0}C. For estimation of oleoresin, ten grams of chilli powder sample was taken in chromatographic column, plugged with stop cork, 50 ml of acetone was added and allowed overnight. The slurry was collected in a pre-weighed beaker and solvent evaporated over a water bath. The collected slurry was cooled and weighed. Difference in weight over sample weight gave per cent oleoresin. Colour value was estimated by alcoholic extract method (Mahindru, 1987). The data of various observations taken were statistically analysed as outlined by Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

In the present experiment it has been obeserved that, After controlled drying of green chilli fruits, significantly highest dried green chilli fruit yield was obtained from G-4 and G-5 and was also numerically similar i.e. 1.69 q ha^{-1}. Significantly highest dried red chilli yield of 10.32 q ha^{-1} was recorded by genotype G-4 followed by G-5 (8.78 q ha^{-1}) and GCL 5-5 (7.87 q ha^{-1}).

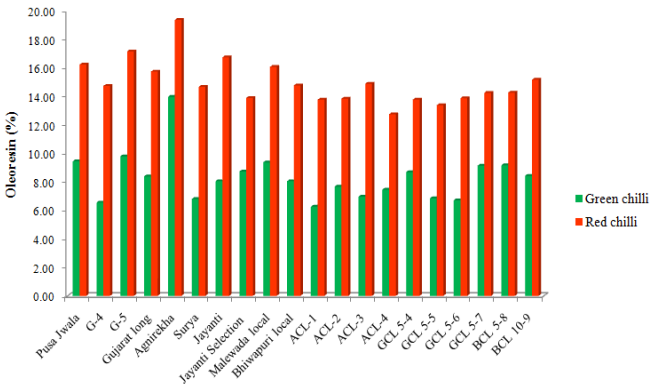

Fig. 1 : Mean oleoresin content in green and red fruits of different chilli genotypes

Ramakrishna and Palled (2005) recorded similar results of significantly higher dry fruit yield (12.24 q ha^{-1}) with 60 cm x 45 cm spacing. Significantly highest 13.95% oleoresin content in green fruits powder was recorded by genotype Agnirekha followed by G-5 (9.78%), Pusa Jwala (9.43%) and Malewada

Table 1. Yield of dry fruit and oleoresin of different chilli genotypes with their mean oleoresin content and colour value at green and red chilli stage

S. No.	Genotypes	Green chilli					Red chilli				
		Yield of dry green chilli (q ha^{-1})	Discoloured green fruit yield (kg ha^{-1})	Oleoresin (%)	Oleoresin yield (kg ha^{-1})	Colour value (ASTA Units)	Yield of dry red chilli (q ha^{-1})	Discoloured red fruit yield (kg ha^{-1})	Oleoresin (%)	Oleoresin yield (kg ha^{-1})	Colour value (ASTA Units)
T_1	Pusa Jwala	0.77	21.26	9.43	7.05	41.54	2.03	2.85	16.21	32.78	194.36
T_2	G-4	1.69	86.96	6.54	10.43	49.25	10.32	12.75	14.71	150.56	216.89
T_3	G-5	1.69	126.98	9.78	14.90	49.24	8.78	61.73	17.13	143.69	274.48
T_4	Gujarat long	0.91	80.81	8.38	7.02	51.36	2.74	7.14	15.72	42.85	153.73
T_5	Agnirekha	0.58	37.43	13.95	7.60	35.60	2.82	7.73	19.34	53.91	238.87
T_6	Surya	1.48	61.11	6.79	9.74	82.46	7.05	4.46	14.65	103.05	235.63
T_7	Jayanti	0.78	55.84	8.04	5.84	37.38	4.58	17.54	16.72	75.02	221.80
T_8	Jayanti Selection	0.72	23.91	8.72	6.03	39.87	1.64	2.66	13.87	22.65	203.26
T_9	Malewada local	0.87	85.77	9.36	7.26	52.22	2.85	7.51	16.05	45.33	199.73
T_{10}	Bhiwapuri local	0.81	29.61	8.04	6.26	35.62	3.49	7.99	14.75	50.92	245.43
T_{11}	ACL-1	1.14	111.04	6.25	6.43	44.51	3.37	5.23	13.75	46.15	200.88
T_{12}	ACL-2	1.09	35.56	7.66	8.10	40.35	3.54	6.28	13.82	48.68	243.61
T_{13}	ACL-3	1.15	54.58	6.96	7.55	36.20	2.67	4.67	14.87	39.53	180.71
T_{14}	ACL-4	1.15	75.62	7.44	7.94	35.37	3.21	4.63	12.73	40.69	219.28
T_{15}	GCL 5-4	0.61	25.93	8.67	5.09	86.05	4.44	10.17	13.76	60.12	225.81
T_{16}	GCL 5-5	1.14	55.22	6.84	7.47	57.56	7.87	11.28	13.36	104.32	225.81
T_{17}	GCL 5-6	1.20	50.02	6.70	7.77	57.54	3.90	3.62	13.86	54.00	206.82
T_{18}	GCL 5-7	0.89	27.28	9.12	7.88	47.47	1.62	1.66	14.23	23.01	247.77
T_{19}	BCL 5-8	0.68	38.38	9.15	5.88	39.76	2.90	7.47	14.25	40.87	210.67
T_{20}	BCL 10-9	0.65	29.63	8.41	5.23	39.16	4.50	4.83	15.15	67.72	240.65
SE (m±)		0.041	0.585	0.102	0.589	0.587	0.055	8.601	0.234	1.179	1.99
CD at 5%		0.118	1.672	0.286	1.685	1.647	0.158	24.589	0.667	3.370	7.21

local (9.36%), Even though, highest oleoresin yield (14.90 kg ha^{-1}) at green fruit stage was noted by genotype G-5 as from it's highest yield of dried green chilli with 9.78 percent of mean oleoresin content. Among all chilli genotypes, highest oleoresin content (19.34%) was noticed in red fruits of Agnirekha, a genotype from MPKV, Rahuri. But, highest oleoresin yield (150.56 kg ha^{-1}) at red fruit stage was recorded by genotype G-4 as from its highest yield of dried red chilli with 14.71 percent of mean oleoresin content. Similar results were observed by Santoshkumar and Shashidhara (2006) as response of chilli genotypes under integrated nutrient management. With regard to oleoresin content, it was increased from green fruits to red ripen fruits as fruits matures and also depends upon genetic constitution of that genotype. Mini and Vahab (2000) also reported that, highest oleoresin yield was obtained when chillies were harvested at turning red stage during summer and at full ripe stage during winter. The factors mainly responsible for oleoresin yield were per cent oleoresin, reduced weight of discoloured fruits and dried fruit yield. Weight of discoloured green and red fruits was significantly lower in Pusa Jwala and GCL 5-7 respectively over other genotypes.

Similar results were observed by Shashidhara (2000). Significantly, highest colour value (86.05 ASTA Units) of green fruits was observed in chilli genotype GCL 5-4 followed by Surya (82.46 ASTA Units). Similar observations were noticed earlier by Uma jyothi *et al.,* (2008) under biochemical evaluation of chilli cultivars with other genotypes. With respect to colour value of red fruits of various chilli genotypes, the highest colour value i.e. 274.48 ASTA Units of red fruits was recorded by chilli genotyope G-5 followed by GCL 5-7 (247.77 ASTA Units), Bhiwapuri local (245.43 ASTA Units) and ACL-2 (243.61 ASTA Units). Similar results were also earlier reported by Prasath *et al.,* (2006) under study on evaluation of chilli germplasm. The colour value is increased in red fruits when compared to green fruits. It might be ascribed due to complete physiological maturity of red fruits rather than green fruits. Another reason might be controlled drying of both green and red chilli by using mechanized drier in Dr.PDKV, Akola. Thus the colour retention is higher in dried produce. The glossiness and luster of dried chillies were also observed to be better than pods dried in farmer's method. Different chilli genotypes recorded non-significant influence on the soil reaction, electrical conductivity and organic carbon content in the soil. However, the soil pH ranges from 8.26 to 8.32 and electrical conductivity of the soil was between 0.52 to 0.56 dS m^{-1}. The organic carbon content in the soil after harvest of chilli genotypes was observed between 5.03 to 5.93 g kg^{-1}. Data as regards of total nitrogen content in soil after harvest of chilli genotypes was non-significant. Whereas significant differences for available phosphorus and potash content has been observed amongst chilli genotypes.

Furthermore, it was noted that the mean average content of total nitrogen, available phosphorus and available potash content in black soil was lower i.e. 0.030 %, 16.58 kg ha^{-1} and 229.86 kg ha^{-1} when fertilized with common recommended dose of NPK fertilizers. The data revealed the significant mining of available phosphorus and potash from the soil.

Conclusion

Among the genotypes, G-5 shown the promising performance with respect to oleoresin yield and colour value, can be suitable for black soil under semi-arid climatic condition.

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