

### Short Communication

## Kashi Bathua-2: A bathua variety for higher nutrient and yield

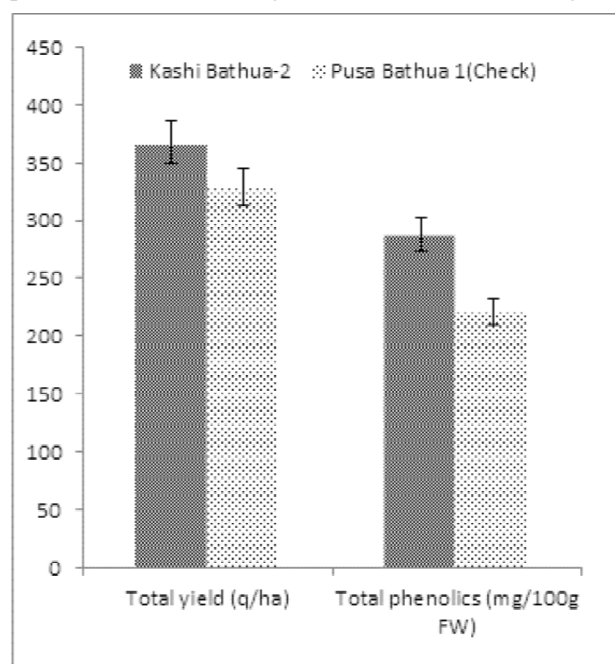
BK Singh\*, Pragya, SNS Chaurasia, B Singh and PM Singh

Received: December 2018 / Accepted: January 2019

Bathua or leafy chenopod (*Chenopodium album* L.) is also known as fat hen, lamb's quarters, goose foot, pigweed, dungweed, melde, etc. Though cultivated in some regions, the plant is also a potentially serious weed in almost all winter-sown crops of the subtropics and tropics. It belongs to family Amaranthaceae, sub-family Chenopodiaceae, genus *Chenopodium*, and species *album* that has almost worldwide distribution and comprises of about 250 species (Risi and Galwey 1984). Some of the other members of this genus are quinoa (*Chenopodium quinoa*), kaniwa (*Chenopodium pallidicaule*), epazote (*Chenopodium ambrosioides*) and good king henry (*Chenopodium bonus-henricus*). It is originated in the Andean region of Bolivia and Peru; and widely distributed in both the northern and southern hemispheres, occurring in Asia, North America, Europe, India, South Africa, Australia and South America (Brenan and Akeroyd 1993). Now it is being grown/cultivated in various countries like USA, Japan, Chile, Africa, India, Sri Lanka, Pakistan, Bangladesh, etc. Generally, the *Chenopodium* are tolerant to cold, drought and salinity, and have potential for cultivation in marginal lands (Sood 2011). *Chenopodium album* plant is extensively consumed in Northern India as a leafy vegetable as well as animal feed in many Asian countries. The succulent soft leaves of bathua contain appreciable amount of dietary fibre; protein; minerals such as Ca, Fe, P, K, Mg, Zn, Mn, Se and Na; vitamins i.e. vitamin-C,  $\beta$ -carotene, niacin, folic acid and riboflavin; antioxidants; omega-6-fatty acid; etc (Yadav et al. 2013, Poonia and Upadhyay 2015, Kole et al. 2016, and Singh and Singh 2017). The effect of feeding chenopodium cultivar on blood lipid profile of rats confirmed the hypocholesterolemic effect by lowering total blood

cholesterol, LDL, VLDL and triglycerides, and increasing HDL content (Sood 2011). The nutritive value of leaves is comparable to that of spinach, amaranthus and cabbage which can be used as substitute. Usually, the leaves are cooked in form of saag (leafy vegetable), mixed with dal/puri/paratha and also eaten in raw form as salad. The high yielding and nutrient rich variety has very much scope to be used as a potential leafy vegetable, leaf concentrate and dry leaf powder that will eventually help in combating the nutritional deficiency.

A high yielding and nutrient rich variety of bathua or leafy chenopod 'Kashi Bathua-2' (IC0619019 or VRCHE-2) has been released from ICAR-Indian Institute of Vegetable Research, Jakhini, Varanasi, Uttar Pradesh. The leaves of 'Kashi Bathua-2' are green in colour and alternate in orientation having green colored shoots. The plants show luxuriant growth habit and tend to grow



**Figure 1:** Yield potential and phenolic content in Kashi Bathua-2 and Pusa Bathua-1

ICAR-Indian Institute of Vegetable Research, Jakhini-221305, Varanasi, Uttar Pradesh

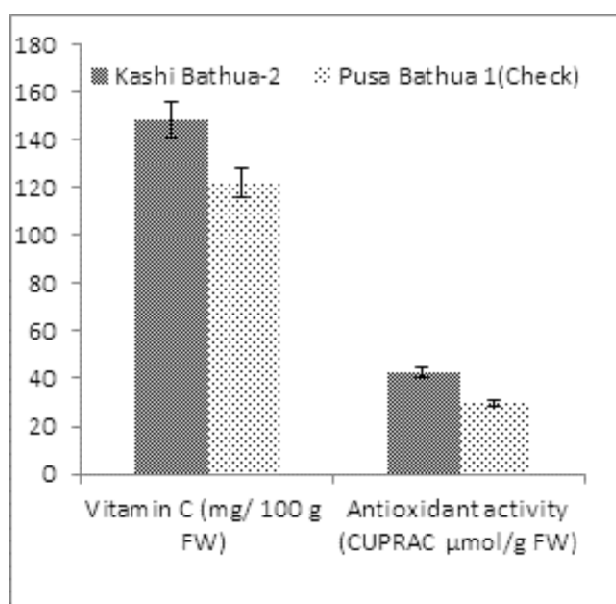
\*Corresponding author, E-mail: bksinghkushinagar@yahoo.co.in

**Table 1:** Morphological, yield and quality traits of Kashi Bathua-2 and check

Year	Variety	Plant height (cm)				Total yield (t/ha)	Dry matter (%)	Vitamin C (mg/100 g FW)	Total phenolics (mg/100g FW)	Antioxidant activity (CUPRAC $\mu\text{mol/g FW}$ )
		40 DAS	80 DAS	120 DAS	160 DAS					
2013-14	Kashi Bathua-2 (VRCHE 2)	19.7	40.2	122.7	181.6	34.7	15.1	150.4	300.1	41.7
	Pusa Bathua 1(Check)	18.9	36.7	109.7	158.9	30.3	15.6	124.8	218.7	28.4
	% increase over national check	4.2	9.5	11.9	14.3	14.6	-3.2	20.5	37.2	46.8
2014-15	Kashi Bathua-2 (VRCHE 2)	17.8	42.5	129.7	197.6	39.6	15.7	149.3	272.4	44.4
	Pusa Bathua 1(Check)	18.4	40.2	118.0	181.0	34.7	16.3	120.5	215.0	31.6
	% increase over national check	-3.1	5.6	9.9	9.2	14.1	-3.7	23.9	26.7	40.6
2015-16	Kashi Bathua-2 (VRCHE 2)	18.9	37.7	127.2	183.2	35.7	14.9	145.2	289.4	41.9
	Pusa Bathua 1(Check)	18.2	37.5	116.4	170.3	33.6	15.5	121.7	229.5	29.5
	% increase over national check	3.6	0.7	9.3	7.6	6.1	-3.7	19.3	26.1	42.2
Average of three years	Kashi Bathua-2 (VRCHE 2)	18.8	40.1	126.5	187.5	36.7	15.2	148.3	287.3	42.7
	Pusa Bathua 1(Check)	18.5	38.1	114.7	170.1	32.9	15.8	122.3	221.1	29.8
	% increase over national check	1.6	5.3	10.3	10.2	11.5	-3.5	21.2	30.0	43.1
	CD at 5%	ns	ns	9.8	11.5	2.9	0.8	16.6	27.6	8.9

DAS: Days after sowing; FW: Fresh weight

upright, reaching heights of 18.8 cm (17.8-19.7 cm), 40.1 cm (37.7-42.5 cm), 126.5 cm (122.7-129.7 cm), and 187.5 cm (181.6-197.6 cm) at 40 days, 80 days, 120 days & 160 days after sowing, respectively; and showed an average of 10.2% higher plant growth than check during evaluation for three years (Table 1). Total yield potential of this variety was harvested 36.7 t/ha (34.7-39.6 t/ha) which was significantly 11.5% higher than check (Table 1, Figure 1). Further, dry matter content was at par with check which ranged from 14.9-15.7% (15.2%), and vitamin-C (ascorbic acid) content in 100 g fresh weight (FW) was estimated significantly higher (21.2% more) i.e. 148.3 mg (145.2-150.4 mg)



**Figure 2:** Vitamin-C and antioxidant ability in Kashi Bathua-2 and Pusa Bathua-1

in newly released variety 'Kashi Bathua-2' (Table 1, Figure 2).

Now-a-days, the importance of phenolics and radical scavenging potential of antioxidants of food items are in discussion because of their wide range of health beneficial properties such as anti-inflammatory, hepatoprotective, anti-atherosclerotic, anti-thrombotic, antibacterial and anti-carcinogenic. Total phenolics content responsible for antioxidant activities was estimated 287.3 mg (272.4-300.1 mg/100 g FW) which was about 30% higher than check variety (Table 1, Figure 1); moreover antioxidant potential in terms of CUPRAC activity (Cupric reducing antioxidant capacity) was quantified 43.1% higher in Kashi Bathua-2 i.e. 42.7  $\mu\text{mol/g FW}$ ; (41.7-44.4  $\mu\text{mol/g FW}$ ; Table 1, Figure 2).

Kashi Bathua-2, a new variety of bathua (leafy chenopod) having green leaves/shoots and luxuriant growth habit whose yield potential is 36.7 t/ha, and possesses 15.2% dry matter, 148.3 mg/100 g FW of vitamin-C (21.2% higher), 287.3 mg/100 g FW of total phenolics (30.0% higher) and 42.7  $\mu\text{mol/g FW}$  of CUPRAC antioxidant activity (43.1% higher) that makes variety suitable for preparing saag, leaf concentrate and dry leaf powder.

## References

- Koley TK, Maurya A, Tripathi A, Singh BK and Singh B (2016) Nutritive vegetables for healthy life. *Indian Hort* 61(1): 38-41.
- Brenan JPM and Akeroyd JR (1993) *Chenopodium L.* In: *Flora Europaea* Volume 1, Psilotaceae to Platanaceae (Tutin TG et al. eds). 2<sup>nd</sup> Edition, Cambridge University Press, Cambridge, UK, pp 111-114.

- Poonia A and Upadhayay A (2015) *Chenopodium album* Linn: review of nutritive value and biological properties. J Food Sci Technol 52(7): 3977-3985.
- Risi J and Galwey NW (1984) The *Chenopodium* grains of the Andes: Inca crops for modern agriculture. In: *Advances in Applied Biology* (Coaker TH Ed), Academic Press, London, pp 145-216.
- Singh BK and Singh B (2017) IC0619019 (VRCHE-2): A bathua genotype for higher nutrient and yield. *Vegetable Newsletter* 4(2): 3.
- Sood P (2011) Physico-chemical, nutritional, biological quality evaluation and value addition of chenopodium (bathua) cultivars. PhD Thesis, Department of Food Science and Nutrition, CSKHPKV, Palampur-176062, HP.
- Yadav RK, Joshi S, Kumar R, Kalia P, Varshney R and Jain V (2013) Studies on different genotypes of Indian bathua (*Chenopodium album*) for their yield, quality and antioxidant activities. *Indian J Agric Sci* 83(1): 26–30.