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SHORT COMMUNICATION

Nutraceutical Profile for Genetic Diversity Assessment in Leafy Mustard (*Brassica juncea* var. *rugosa*) Genotypes

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Mustard greens are an excellent source of many vitamins, dietary fiber, phosphorus, protein and iron as well as a good source of a potassium and magnesium. All genotypes showed variability in nutraceutical property. Highest content of protein was found in FS-13-17 (32.68%). Genotype FS-13-15 has high content of P, S and K Genotypes PRHC-12-14, FS-13-12 and FS-13-1 recorded highest value for S content whereas, EEC-10 had maximum K content. Iron and Manganese content was found maximum in genotype FS-13-10 (37.52mg/100g) and PRHC-12-6 (7.97 mg/100g) respectively. Highest content of Zinc was found in MGVAR-2 (5.83 mg/100g). These genotypes were promising and can be utilized for further improvement programme in leafy mustard. The genotypes which are rich in nutraceutical properties can be used for plant bio-fortification and such bio-fortified plant/varieties are safe for human consumption.

Key Words: Genotypes, Leaf, Mustard, Nutrient, Protein

Introduction

Mustard or hill mustard is popularly known as Rai, Raya, Lahi, Laha, Sarson etc.Lahi (*Brassica juncea*. var. *rugosa*) is well known in hills as green vegetable during the winter season. Leafy Mustard is a rich source of vitamins and minerals (Rawat *et al.,* 1978). Its tender leaves and stalk in early stages are used as green vegetable in the plains and hills of Northern India. In addition to providing these wondrously nutritious greens, this plant also produces the acrid tasting brown seeds that are used to extract vegetable oil. Mustard greens add a pungent and peppery flavour to recipes in which they are featured. Mustard (*Brassica juncea* (L.) Czern.) is an important crop both agriculturally and economically, which is widely cultivated in Asia and Europe (Chen and Chen, 1992), which belongs to family *Brassicaceae*. *Brassica* crops harbor an enormous diversity and had adapted to cultivation in almost every part of the world.Mustard greens seem to originated in the Himalayan region of India and have been grown and consumed for more than 5,000 years (Vavilov, 1926; Singh, 1958). However, the exact origin is unknown, but as an amphidiploid it seems logical that it originated in an area where the parental species *Brassica nigra* (L.) Koch (2n=16) and *Brassica rapa* L. (2n=20) overlap in their distribution (e.g. central Asia). It is generally agreed that the primary centre of diversity of *Brassica juncea* (2n=36) is Central Asia with secondary centres in Central and Western China, Hindustan and Asia Minor. In India, a great diversity exists in *B. juncea* for plant type, seed size, siliqua length, oil content and maturity period (Rana and Singh, 1992; Mishra *et al.* 2012; Semwal *et al*., 2013). It is largely self-pollinated crop with an average of 7.5–30% outcrossing does occur under natural conditions (Rabbani *et al.* 1998). *Brassica juncea* (2n =36) is an erect annual to biennial herb, 300-1600 mm tall, normally unbranched, sometimes with long ascending branches in upper parts; in appearance it is sub-glabrous and sub-glaucose. Mustard green is very nutritious and high in vitamin A, C, and iron. The leaf contain 24 calories, 2.4 gram protein, 0.4 gram fat, 4.3 gram total carbohydrate, 1.0 gram fibre, 1.1 gram ash, 160 mg calcium, 48 mg phosphorus, 2.7 mg iron, 24 mg sodium, 297 mg potassium, 0.06 mg thiamine, 0.14 mg riboflavin, 0.8 mg niacin, and 73 mg ascorbic acid per 100g. Both seed and leaves contain the glucosinolate-sinigrin (USDA, 2020).Genetic diversity plays a significant role in plant improvement because a hybrid between the lines of diverse origin usually display a greater heterosis than those between closely related ones (Singh and Chowdhury, 1983; Naznin *et al.,* 2015) which permit the selection of genetically

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divergent plants to obtain the desirable recombination of segregating generation.

Mustard greens are an excellent source of many vitamins including vitamin K, vitamin A, vitamin C and vitamin E. They are a very good source of dietary fiber, phosphorus, protein and iron as well as a good source of a potassium and magnesium. The iso-thiocyanates like compounds have been identified in mustard greens plants (Hirai *et al*., 2007). These compounds are known for their fungicidal, bactericidal, nematocidal and allelopathic properties (Moreno *et al.,* 2006) and are recently gaining popularity as cancer chemo-preventive and chemotherapeutic agents.

For bio-fortification and to mark nutrient rich germplasm, it is necessary to estimate the nutritional value of leafy green mustard. Present experiment was conducted to determine the nutrient content of thirty two genotypes. The final goal of research is to mark those genotypes which are rich in nutrient content and use these genotypes in development of nutrient rich varieties through bio-fortification and biotechnology.

Material and Methods

The experimental material consisted of 32 leafy mustard genotypes out of which 27 were obtained from the Pantnagar Centre for Plant Genetic Resources of G.B. Pant University of Agriculture and Technology, 4 genotypes from IET, AVT and 1 prominent check, PUSA SAG-1 was received from IARI (Table 1). The research was carried out at Vegetable Research Centre (VRC), G.B. Pant University of Agriculture and Technology, Pantnagar, U.S. Nagar (Uttarakhand) in *rabi* season of 2015-2016. The crop was raised in the field in Randomized Block Design with one check. The recommended package of practices was followed and the significance of difference among treatment means will tested by F-test. Wherever, the F-test found to be significant, critical difference (CD) at 5 per cent level of significance was calculated. D^2 statistic was used for accessing the genetic diversity among the genotypes **(**Mahalanobis, 1936**).** The data recorded during the course of experiment were subjected to analysis through computer by using Windostat version 9.2 from Indostat services, Hydrabad Licensed to Plant Breeding Division Sugarcane Breeding Institute Coimbatore.

Nutrient Analysis

For nutrient analysis, leaves of leafy mustard were collected, dried and used for further analysis of nutrient i.e., protein by rapid N-cube analyser, P and S by spectrophotometer, K by flame photometer and Fe, Zn, Cu, Mn by atomic absorption spectrophotometer. Diacid method was followed for plant nutrient analysis of Zn, Fe, Mn, Cu, P, S and K. Fresh leaf samples were taken and dried first at 60^{o}C and then at 75^{o}C till weight became constant. Dried leaf samples were ground in a Wiley Mill. 1g of finely powdered leaves were taken into 150 ml conical flask and 10 ml concentrated HNO_3 were added to each flask and kept overnight while covering the mouth. The flasks were heated on a hot plate for 30 minutes. After cooling, 10 ml 4:1 of nitric and perchloric acids were added and heated at 40^{o}C till completion of digestion. Brown fumes of nitric acids evolve first and

Table 1. List of genotypes of leafy mustard used in the study

Genotypes	Source	Genotype	Source
2014/MGVAR-1	IET, AVT	FS-13-4	PCPGR, Pantnagar
2014/MGVAR-2	IET, AVT	FS-13-5	PCPGR, Pantnagar
2014/MGVAR-3	IET, AVT	FS-13-7	PCPGR, Pantnagar
2014/MGVAR-4	IET, AVT	FS-13-8	PCPGR, Pantnagar
PRHC-12-6	PCPGR, Pantnagar	FS-13-9	PCPGR, Pantnagar
PRHC-12-7-2	PCPGR, Pantnagar	FS-13-10	PCPGR, Pantnagar
PRHC-12-9-1	PCPGR, Pantnagar	FS-13-11	PCPGR, Pantnagar
PRHC-12-9-2	PCPGR, Pantnagar	FS-13-12	PCPGR, Pantnagar
PRHC-12-11	PCPGR, Pantnagar	FS-13-13	PCPGR, Pantnagar
PRHC-12-12	PCPGR, Pantnagar	FS-13-14	PCPGR, Pantnagar
PRHC-12-13	PCPGR, Pantnagar	FS-13-15	PCPGR, Pantnagar
PRHC-12-14	PCPGR, Pantnagar	FS-13-16	PCPGR, Pantnagar
EEC-10	PCPGR, Pantnagar	FS-13-17	PCPGR, Pantnagar
FS-13-1	PCPGR, Pantnagar	FS-13-18	PCPGR, Pantnagar
FS-13-2	PCPGR, Pantnagar	FS-13-20	PCPGR, Pantnagar
FS-13-3	PCPGR, Pantnagar	PUSA SAG 1	IARI, New Delhi

Table 2. Analysis of Variance for different nutrient characters in leafy mustard

Source	d.f.	Protein (%)	P (mg/100g)	S (mg/100g)	K (mg/100g)	Fe (mg/100g)	Mn (mg/100g)	Zn (mg/100g)
Replication	2	0.14836	524.63	3728.52	1813.01	0.51532	0.06126	0.00195
Treatment	31	26.64**	72279.8**	1073231**	600070**	115.67**	5.43**	2.36**
Error	62	0.50883	1039.62	928.302	3708.42	0.21579	0.02235	0.01275

** Highly significant at 1% level

towards end of digestion evolution of white fumes of perchloric acids. A semi solid viscous material of light brownish colour gets reduced to traces of whitish residue at the bottom of the flask towards the end of digestion. The process completes in a period of 1-2 hrs. In no case full drying should be allowed as there may be chances of volatilization loss of some nutrients. If the samples show charring then an extra 10 ml of HNO_3 is added to the flask and digested again. When the digestion is successfully over, the conical flask is removed from hot plate and cooled and 5ml of 6 N HCL along with few ml of water were added. The contents were boiled gently and transferred to a 100 ml volumetric flask and the volume was maintained by using distilled water. The diluted sample were filtered and stored for further analysis. Macronutrients i.e., Phosphorus and sulphur was analyzed by spectrophotometer and potassium by flame photometer. For the determination of phosphorus yellow colour method was followed. 10ml sample prepared by following diacid method was taken in 50 ml volumetric flask and 10 ml distilled water and 10 ml ammonium molybedate reagents were added to it. It was diluted to 50 ml and mixed well. After 20-25 minutes, when yellow colour was fully developed, Transmittance (%) or Absorbance at 420 nm was recorded. Standard curve in the range of 0 to 15 ppm phosphorus in the final solution were prepared. For estimation of sulphur, 5-10 ml sample prepared by following diacid method was taken in 50 ml volumetric flask and 1 ml 6N HCl and 1 ml of gum acacia solutions were added to it. The contents were mixed by swirling. 0.5g barium chloride crystals were added and the volume was made up to 50 ml using distilled water. The flask was allowed to stand for one minute and then swirled gently until the barium chloride crystals were dissolved. The absorbance for diluted plant digest was recorded on spectrophotometer at 420 nm. Standard curve in the range of 0, 4, 6, 12 and 20 ppm sulphur in the final solution were prepared. The plant sample for potassium was prepared in the same method like that for micronutrient analysis. 5 ml of digested sample was taken in 25 ml volumetric flask and diluted up to the mark using distilled water. Standard curve of K was prepared by aspirating standard K solutions (0-10 µg/ml) in flame photometer and readings were noted for each solution. The concentration of K in diluted plant sample digest was computed with the help of standard curve.

Micronutrient like Zinc, Iron, Manganese and Copper was analyzed by atomic absorption spectrophotometer. Sample prepared by following diacid method is taken for micronutrient estimation. A volumetric flask (100 ml) containing samples were filtered through Whatman No.42 filter paper placed over plastic bottle of volume 100 ml. These samples were fed to atomic absorption spectrophotometer and readings were noted in µg/ml. This reading was multiplied by dilution factor 100 and converted into mg/kg or multiplied by 10 to convert into mg/100gm (Pathak and Agrawal, 2014).

Result and Discussion

The analysis of variance different characters is presented in Table 2. Among all the genotypes highly significant differences were obtained for all the characters namely; protein, P, S, K, Fe, Mn and Zn contents which indicate that variation was due to genetic effects. The significance of genotype difference indicates the presence of variability for each of the characters among the tested genotypes. The exploitation of diversity is of much importance for an effective breeding programme and is a prerequisite for effective screening of superior genotypes.

Proteins are essential nutrients for the human body**.** It perform a vast array of functions within organisms, including catalysing metabolic reactions, DNA replication, responding to stimuli, and transporting molecules from one location to another. Highly significant differences among all the genotypes were observed for protein content (Table 2).Protein content ranges from 32.68% to 20.12% (Table 3). FS-13-17 has the highest protein content (32.68%) followed by FS-13-16 (31.61%) and FS-13-15 (30.11 %) whereas minimum protein content was found in EEC-10

Table 3. Nutrient content in different genotypes of leafy mustard

Genotype	Protein (%)	P (mg/100g)	S (mg/100g)	K (mg/100g)	Fe (mg/100g)	Mn (mg/100g)	Zn (mg/100g)
2014/MGVAR-1	25.41 ± 0.17	1083 ± 0.001	695 ± 0.001	2100 ± 0.07	8.96 ± 0.26	3.59 ± 0.02	3.75 ± 0.05
2014/MGVAR-2	23.06 ± 0.57	1156 ± 0.001	1010 ± 0.006	1750 ± 0.02	26.46 ± 0.02	4.47 ± 0.04	5.83 ± 0.04
2014/MGVAR-3	24.27 ± 0.31	1034 ± 0.001	720 ± 0.009	2080 ± 0.05	14.89 ± 0.02	7.33 ± 0.01	4.41 ± 0.18
2014/MGVAR-4	27.63 ± 0.01	1287 ± 0.001	280 ± 0.006	2300 ± 0.06	24.68 ± 0.28	6.96 ± 0.02	5.24 ± 0.02
PRHC-12-6	26.25 ± 0.07	1239 ± 0.001	990 ± 0.012	2080 ± 0.02	16.94 ± 0.27	7.97 ± 0.02	5.19 ± 0.02
PRHC-12-7-2	22.53 ± 0.42	1395 ± 0.001	670 ± 0.019	2680 ± 0.02	6.49 ± 0.11	3.60 ± 0.01	3.58 ± 0.18
PRHC-12-9-1	27.84 ± 0.26	1451 ± 0.001	740 ± 0.015	3030 ± 0.17	11.96 ± 0.46	4.78 ± 0.06	4.01 ± 0.12
PRHC-12-9-2	24.55 ± 0.14	948 ± 0.001	870 ± 0.015	1900 ± 0.08	15.87 ± 0.63	5.29 ± 0.06	4.42 ± 0.04
PRHC-12-11	23.51 ± 0.42	1348 ± 0.001	1020 ± 0.023	3050 ± 0.05	13.49 ± 0.34	6.74 ± 0.06	4.86 ± 0.31
PRHC-12-12	28.16 ± 0.29	983 ± 0.001	960 ± 0.015	1700 ± 0.11	13.20 ± 0.16	4.64 ± 0.08	4.09 ± 0.10
PRHC-12-13	20.31 ± 0.32	1249 ± 0.001	470± 0.009	1980 ± 0.10	21.87 ± 0.03	3.30 ± 0.02	2.66 ± 0.16
PRHC-12-14	26.51 ± 0.16	1358 ± 0.001	2150 ± 0.02	2650 ± 0.11	8.78 ± 0.06	4.27 ± 0.04	4.32 ± 0.12
EEC-10	20.12 ± 0.31	903 ± 0.001	1080 ± 0.01	3150 ± 0.01	16.13 ± 0.33	4.96 ± 0.07	3.73 ± 0.06
FS-13-1	25.96 ± 0.12	1284 ± 0.001	2150 ± 0.02	1700 ± 0.14	13.44 ± 0.14	2.31 ± 0.03	2.42 ± 0.09
FS-13-2	22.22 ± 0.09	1027 ± 0.001	1550 ± 0.02	2750 ± 0.05	13.92 ± 0.17	3.73 ± 0.02	3.47 ± 0.09
FS-13-3	23.58 ± 0.22	1187 ± 0.001	920 ± 0.04	2280 ± 0.12	16.72 ± 0.09	6.00 ± 0.22	3.62 ± 0.04
FS-13-4	25.94 ± 0.33	1344 ± 0.001	1190 ± 0.006	2320 ± 0.13	13.39 ± 0.17	4.40 ± 0.28	4.57 ± 0.02
FS-13-5	26.60 ± 0.38	1402 ± 0.001	690± 0.006	2830 ± 0.01	19.07 ± 0.05	4.41 ± 0.04	2.93 ± 0.15
FS-13-7	23.66 ± 0.03	1272 ± 0.001	950 ± 0.01	2950 ± 0.02	20.25 ± 0.02	4.92 ± 0.02	5.76 ± 0.01
FS-13-8	25.49 ± 0.43	1159 ± 0.001	500 ± 0.09	2380 ± 0.03	22.09 ± 0.04	3.90 ± 0.08	5.78 ± 0.03
FS-13-9	23.27 ± 0.26	1210 ± 0.001	990 ± 0.01	1700 ± 0.15	17.08 ± 0.09	6.28 ± 0.03	3.53 ± 0.04
FS-13-10	21.43 ± 0.18	1328 ± 0.001	2030 ± 0.009	2320 ± 0.01	37.52 ± 0.48	4.91 ± 0.01	4.64 ± 0.04
FS-13-11	26.55 ± 0.52	1190 ± 0.001	1020 ± 0.01	2530 ± 0.01	11.42 ± 0.03	4.14 ± 0.03	5.22 ± 0.02
FS-13-12	25.41 ± 0.13	1030 ± 0.001	2150± 0.01	2100 ± 0.02	12.57 ± 0.03	4.94 ± 0.01	4.31 ± 0.03
FS-13-13	22.28 ± 0.23	1173 ± 0.001	1400± 0.009	2080 ± 0.03	24.83 ± 0.03	6.04 ± 0.08	3.58 ± 0.04
FS-13-14	21.57 ± 0.05	1399 ± 0.001	2120 ± 0.02	2280 ± 0.02	17.06 ± 0.01	6.30 ± 0.02	4.71 ± 0.02
FS-13-15	30.11 ± 0.42	1471 ± 0.001	150 ± 0.003	2950 ± 0.10	13.15 ± 0.39	4.44 ± 0.25	4.54 ± 0.04
FS-13-16	31.61 ± 0.36	1029 ± 0.001	1800 ± 0.012	3030 ± 0.08	15.93 ± 0.47	6.15 ± 0.02	3.57 ± 0.02
FS-13-17	32.68 ± 0.43	1058 ± 0.001	830 ±0.10	2000 ± 0.15	22.70 ± 0.04	7.05 ± 0.06	4.63 ± 0.03
FS-13-18	26.45 ± 0.36	1146 ± 0.001	90 ±0.02	2200 ± 0.03	19.67 ± 0.01	6.92 ± 0.08	5.48 ± 0.01
FS-13-20	23.81 ± 0.42	1042 ± 0.001	370 ±0.02	1980 ± 0.18	11.00 ± 0.03	6.19 ± 0.08	5.14 ± 0.04
Pusa Sag 1	26.62 ± 0.52	1140 ± 0.001	1550 ± 0.08	2800 ± 0.05	21.58 ± 0.04	4.63 ± 0.01	4.63 ± 0.03

(20.12 %). Rest of genotypes showed protein content between the genotypes mentioned above (Table 3). Gupta and Wagle (1988) also reported high protein value in mustard i.e. 29.82%. Manchali *et al.* (2012) also reported high protein content in cruciferous vegetables. Similar results were reported by Aletor (1995), Fasuyi (2006), Gupta *et al.* (2005) and Meena *et al.* (2020).

Phosphorus is the second most abundant mineral in the body, after calcium. Phosphorus is an essential mineral primarily used for growth and repair of body cells and tissues. Data revealed that there was a significant difference among all the genotypes for phosphorus content (Table 2). Phosphorus content ranged from 903 to 1471 mg/100g. FS-13-15 has the highest phosphorus content (1471mg/100g) followed by PRHC-12-9-1 (1451 mg/100g) and FS-13-5 (1402 mg/100g) whereas minimum phosphorus content was found in EEC-10 (903 mg/100g). Other genotypes give intermediate phosphorus content (Table 2).The results were in agreement with findings of Gupta and Wagle (1988). Aletor(1995) also find the similar results.

Sulphur is one of the core chemical elements needed for biochemical functioning and is an elemental macronutrient for all organisms. Mustard greens are perhaps most famous as a group for their unusual sulphur content and especially their sulphur containing glucosinolates. Sulphur content of all the genotypes is given in Table 3. Data showed that the range of sulphur content was from 90 to 2150 mg/100g. PRHC-12-14, FS-13-12 and FS-13-1 has the maximum sulphur content (2150 mg/100g) followed by FS-13-14 (2120mg/100g) and FS-13-10 (2030mg/100g) while minimum in FS-

13-18 (90mg/100g). Ifon and Bassir (1979) also found high amount of sulphur content in some Nigerian leafy vegetables.

Potassium ions are necessary for the function of all living cells. The transfer of potassium ions through nerve cell membranes is necessary for normal nerve transmission. Potassium is pivotal to heart function and plays a majorpart in skeletal and smooth muscle contraction, so is crucial for normal digestive and muscular function. The data displayed in Table 3 showed highly significant differences for potassium content among all the genotypes. Potassium content ranged from 1700 to 3150 mg/100g (Table 3).EEC-10 has the highest potassium content (3150 mg/100g) followed by PRHC-12-11 (3050 mg/100g), PRHC-12-9-1 and FS-13-16 (3030 mg/100g) whereas minimum potassium content was found in PRHC-12-12, FS-13-1 and FS-13-9 (1700 mg/100g). Other genotype showed in between values of potassium content. The similar results were also observed by Gupta and Wagle (1988), Ifon and Bassir (1979) and Fasuyi (2006).

Data revealed that iron content ranged from 6.49 to 37.52mg/100g (Table 3). Highly significant differences among the genotypes for iron content were observed (Table 3). FS-13-10had highest content of iron (37.52mg/100g) followed by MGVAR-2(26.46mg/100g), whereas minimum iron content was found in PRHC-12-7-2 (6.49mg/100g) followed by PRHC-12-14 (8.78mg/100g). Rest genotypes showed intermediate iron content. Gupta and Wagle (1988) found iron content as high as 45mg/100g for mustard leaves. The findings are in accordance with the findings of Bhatt and Singh, 2015 in fenugreek.

Data presented in Table 3 depicted that there was a significant difference for manganese content among all the genotypes. The manganese content ranged from 2.31 to 7.97 mg/100g (Table 3). PRHC-12-6 has highest content of manganese (7.97 mg/100g) followed by MGVAR-3 (7.33 mg/100g). The minimum manganese content was found in FS-13-1 (2.31 mg/100g) followed by PRHC-12-13 (3.30 mg/100g). Rest genotypes showed intermediate manganese content. The results are in consonance with Gupta and Wagle (1988) and Singh *et al.* (2001).

The perusal of results in Table 3 showed that genotypes differ significantly for this parameter. Zinc content ranges from 2.42 to 5.83 mg/100g (Table 3). Highest content of zinc was found in MGVAR-2 (5.83 mg/100g) followed by FS-13-8 (5.78 mg/100g).Whereas minimum zinc content was in FS-13-1 (2.42 mg/100g) followed by PRHC-12-13 (2.66 mg/100g). Rest genotypes had intermediate zinc content. Zinc is vital for the immune system and zinc also prevents night blindness and prevents development of cataract. Manchali *et al*. (2012), Singh *et al*. (2001) and Aletor (2002) also have the similar results for zinc content.

In present study the copper content in dry leaves was found below detection limit during analysis. The similar results found by Gupta *et al*. (2005), Aletor (1995) and Aletor (2002).

MGVAR-2 is source of iron and zinc, FS-13-10 is rich source of sulphur and iron, FS-13-17 is rich source of protein and manganese, FS-13-15 is rich source of protein and phosphorous and PRHC-12-9-1 is rich source of phosphorous and potassium among all the genotypes. These results are in conformity with the findings of Gupta and Wagle (1988) and also found variation among genotypes for micronutrient contents. They found nutrient content ranges iron from 25 to 72 mg/100g, zinc from 2.2 to 4.2 mg/100g, manganese from 4.3 to 14.0 mg/100g, potassium from 58 to 3802 mg/100g and phosphorous from 740 to 1210 mg/100g, respectively. The results indicate that mustard genotypes cultivated at different locations exhibited variation in the content of mineral elements.

All thirty two genotypes had a wide range of variation for most of the characters. The traits varied in terms of their behaviours and extent of genetic variability. All genotypes were rich in protein content, macronutrient content (P, S and K) and micronutrient content therefore, these genotypes can be considered longevity promoter that will boost the overall health status on consumption meet out the daily need of nutrition.

Conclusion

The nutrient composition of mustard leaves revealed them to be good sources of many nutrients that could help in overcoming micronutrient malnutrition at a negligible cost.The comparatively high content of sulphur in some of the leafy mustard genotypes is important as sulphur has recently been implicated in the detoxification of cyanide in local foodstuffs. This investigation can serve as a basis for selecting promising genotypes for further, more detailed, multi-year, multi-plot studies on leafy mustard to meet the nutritional requirements.

Because of their high nutrient content, greens can be recommended to alleviate micronutrient malnutrition in developing countries. FS-13-15, PRHC-12-14, FS-13-12, FS-13-1, EEC-10, FS-13-10, PRHC-12-6 and MGVAR-2 genotypes can be used in the breeding program for crop improvement as a donor for many nutritional traits and they can be safely utilized for human consumption.

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