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BREEDING FOR NUTRITIONAL STABILITY IN KODO MILLET

G. K. KOUTU, S. P. SINGH AND C. B. SINGH

Department of Plant Breeding & Genetics, College of Agriculture, Khandwa 450001

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ABSTRACT

Stability analysis for protein and carbohydrate content was carried out in 30 diverse genotypes of kodo millet (*Paspalum serobiculatum* L.) grown at four locations. Genotype x environment linear interactions were significant for both the traits. Genotypes IPS-147, IPS-200, IPS-198, IPS-112, IPS-66, IPS-138, IPS-115 appeared stable; hence they may be of use in breeding stable cultivars for these traits.

Key words: Kodo millet, stability, protein, carbohydrate, G x E interaction.

Kodo millet (*Paspalum secrobiculatum* L.) is an important source of protein and energy for the tribal community in Madhya Pradesh. Efforts for improvement of these traits can help to resolve the nutritional problem of tribals to some extent. Protein content has been reported to exhibit low to moderate heritability [1], indicating a considerable role of the environment. Munck [2] reported significant genotype x environment interaction for protein content in rice. The present investigation aims to identify kodo millet cultivars with stable performance for protein and carbohydrate content.

MATERIALS AND METHODS

The study was based on 30 genotypes selected for high yield and high protein content from among 100 lines. They were sown in a randomized complete block design with three replications at four locations, viz. Jabalpur, Dindori, Chhindwara and Rewa. Each plot consisted of 5 rows of 3 m length, with a spacing of 25 x 7.5 cm. Protein and carbohydrate contents (%) were determined following the standard procedures [3, 4]. Crude protein estimates were obtained by multiplying total nitrogen with the conversion factor of 6.25. Stability analysis was done according to Eberhart and Russell [5].

RESULTS AND DISCUSSION

Mean squares due to genotypes were significant for protein and carbohydrate contents. The environment (linear) mean squares showed significant differences for protein content indicating the sensitivity of the trait to the environments. Genotype x environmental linear interaction was significant for both protein and carbohydrate contents, indicating that both the predictable and unpredictable components shared G x E interaction. Similar results were reported earlier in sorghum and foxtail millet [6–8].

PROTEIN CONTENT

Protein content in cereals show low to moderate heritability [9, 10]. Therefore, identification of genotypes having relatively consistent performance over environments may be beneficial. Genotypes IPS-199, IPS-149, IPS-110, IPS-163 and IPS-161 had regression coefficient near unity and had mean around the grand mean, suggesting that they had above average stability. They may, thus, be recommended for poor environments. The genotypes IPS-105, IPS-163, IPS-88, IPS-194, IPS-76, IPS-65, IPS-177, IPS-164 and IPS-107 had regression coefficients above unity coupled with very low mean over environments, indicating their stability was below average.

Table 1. Stability analysis (mean squares) of variance for protein and carbohydrate content in kodo millet

Source	d.f.	Protein	Carbo-hydrate
Genotypes (G)	29	16.23**	54.26
Environments (E)	3	0.16	0.41
G x E	87	0.089	0.73
Envi. (Lin.)	1	0.48**	1.12
G x E (Lin.)	29	0.13**	1.16**
Pooled deviation	60	0.064	0.50
Pooled error	237	0.190	1.71

Genotypes IPS-113, IPS-86, IPS-109, IPS-183, IPS-147-1, IPS-202, IPS-192 and IPS-136 showed regression coefficient greater than one, and exhibited high mean values, indicating that the high protein content from these genotypes can be harvested only under optimum conditions.

Genotypes IPS-147, IPS-200, IPS-198, IPS-112, IPS-66, IPS-138 and IPS-115 were highly stable with mean values greater than the population average. Thus they may be suitable for a wide range of environments, and are desirable in breeding programmes for improvement of these traits.

CARBOHYDRATE CONTENT

Genotypes IPS-113, IPS-65, IPS-47, IPS-109, IPS-183, IPS-198, IPS-202, IPS-138 and IPS-136 had regression coefficients less than unity coupled with mean values less than the

Table 2. Stability parameters for protein and carbohydrate content in kodo millet

Genotype	Protein			Carbohydrate		
	mean (%)	b_i	S^2_{di}	mean (%)	b_i	S^2_{di}
IPS-199	3.1	-0.07	-0.06	73.4	0.02	-0.57
IPS-149	3.2	-0.92	-0.06	72.0	-0.00	-0.56
IPS-105	4.1	1.48	-0.05	72.0	1.13	0.55
IPS-163	3.3	1.55	-0.04	68.8	1.30	-0.56
IPS-110	3.2	0.25	-0.04	72.1	-0.98	-0.54
IPS-63	3.7	0.24	-0.05	70.2	0.44	-0.57
IPS-68	3.2	1.23	-0.05	75.2	0.00	-0.46
IPS-113	6.4	3.87	-0.06	67.2	0.09	-0.56
IPS-161	3.2	-0.77	-0.06	72.2	-0.92	-0.55
IPS-194	3.2	2.04	-0.02	71.3	-1.37	-0.56
IPS-76	3.9	-4.86	0.06	74.6	0.96	-0.42
IPS-65	3.4	1.31	0.02	74.4	-1.31	-0.49
IPS-177	3.8	-3.18	-0.06	73.4	-1.82	-0.47
IPS-164	3.2	1.28	-0.06	72.6	29.0	0.30
IPS-86	7.1	5.61	0.41	5.8	2.37	3.73
IPS-147	7.8	0.87	-0.01	65.1	-0.43	-0.41
IPS-109	7.4	-1.46	0.08	64.8	0.21	-0.53
IPS-183	6.3	-1.86	0.02	67.5	-3.25	1.57
IPS-200	6.3	0.75	-0.06	67.7	2.26	-0.31
IPS-147-1	7.4	1.15	0.14	66.1	4.81	0.36
IPS-198	6.3	0.71	-0.01	68.0	-0.35	-0.30
IPS-202	6.5	2.29	-0.03	68.0	0.19	-0.53
IPS-112	7.5	0.89	-0.05	70.2	1.32	-0.21
IPS-66	7.2	-0.32	-0.05	67.1	0.18	-0.40
IPS-107	4.2	-3.99	0.11	73.1	-3.36	1.65
IPS-161	7.2	6.30	0.05	65.7	1.95	1.69
IPS-192	8.2	2.01	-0.06	62.8	-2.41	-0.07
IPS-138	8.2	0.43	-0.06	63.9	0.04	-0.29
IPS-115	7.2	-0.16	0.01	64.7	1.91	-0.41
IPS-136	9.1	5.22	0.10	65.4	0.05	-0.35

average; these genotypes are hence recommended for poor environments. Genotypes IPS-163, IPS-86, IPS-183, IPS-200, IPS-147-1, IPS-111, IPS-192 and IPS-115 recorded regression coefficient above unity but very low mean values over environments, indicating

a below average stability of these genotypes. The genotypes IPS-199, IPS-149, IPS-88, IPS-63, IPS-161 and IPS-76 had regression coefficients less than unity with above average mean values, indicating that they are highly stable for a wide range of environments.

Thus, genotypes IPS-147, IPS-200, IPS-198, IPS-112, IPS-66, IPS-138 were stable over a wide range of environment both for protein and carbohydrate contents. Hence these genotypes can be improved and recommended for the entire tribal area of M.P. Genotypes IPS-199, IPS-149, IPS-110, IPS-163 and IPS-161 had average stability. Thus these genotypes can be used for breeding superior genotypes in nutritional quality with stable performance under poor fertility level, light soil and rainfed condition.

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