Identification of superior pearl millet napier hybrids with enhanced green fodder yield and quality through genetic variability studies

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Abstract

An investigation was carried out with fifteen pearl millet napier hybrids in Tamil Nadu Agricultural University during *Kharif*, 2021 to assess the variability, heritability and genetic advance of different green fodder yield related traits and fodder quality traits. The estimates of phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) exhibited a greater genetic variability for the traits leaf weight, number of internodes per tiller, green fodder yield per plant, dry matter yield per plant, stem weight, number of tillers plant, crude fat content and crude protein content. High heritability coupled with high genetic advance were recorded for all the studied traits except dry matter content and crude fibre content. Selection of traits with high PCV, GCV, heritability and genetic advance would help the breeder in identifying the traits contributing for enhanced green fodder yield in pearl millet napier hybrids.

Key words: Variability, heritability, genetic advance, green fodder, fodder quality.

Introduction

Livestock are considered as the spine of arid farming system as they contribute to 50% of farmers' revenue. Among various fodder crops, pearl millet hybrids are highly prized for their prodigious supply of herbage, their palatability and high quality (Lokhande, 2015). The pearl millet napier hybrid is produced through the interspecific hybridization between pearl millet (*Pennisetum glaucum*) and napier grass (*Pennisetum purpureum*). It combines fodder quality of pearl millet with high yielding potential and perennial nature of napier grass. Being a highly nutritious crop, pearl millet napier hybrids can be grown as a sole crop to meet the balanced nutrition required for dairy animals. The hybrids provide surplus green fodder round the year with copious irrigation and once planted it can be maintained continuously in the field

for three years (Satapute *et al*., 2014). The grass is fed to animals directly as green fodder besides its suitability for hay and silage making.

The pearl millet and napier grass are readily crossable and produces more vigorous hybrid. Selection of hybrids for higher fodder yield and quality is prerequisite for its improvement. In this regard, the present study was aimed to assess the genetic variability, heritability and genetic advance of different morphological characters associated with green fodder yield and fodder quality traits in pearl millet napier hybrids.

Materials and methods

The present study was carried out in the experimental fields of New Area Farm, Department of Forage Crops, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore, Tamilnadu, India during *Kharif*, 2021. Fifteen pearl millet napier hybrids (GP15074 × FD482, GP15074 × FD464, GP15074 × FD465, GP16016 × FD482, GP16016 × FD464, GP16016 × FD465, GP15073 × FD482, GP15073 × FD464, GP15073 × FD465, GP15958 × FD482, GP15958 × FD464, GP15958 × FD465, GP15988 × FD482, GP15988 × FD464, GP15988 × FD465) were planted in randomized block design with two replication using rooted slips. A spacing of 60 cm × 50 cm was adopted among the hybrids while planting and all the recommended agronomic package of practices were followed during the growing season. Morphological traits such as plant height (PH), number of tillers per plant (NOT), number of internodes per tiller (NOI), number of leaves per tiller (NOL), leaf length (LL), leaf width (LW), stem girth (SG), leaf weight (LW), stem weight (SW), leaf to stem ratio (L:S), dry matter yield per plant (DMY), dry matter content (DMC) and green fodder yield per plant (GFY) were recorded on five randomly selected plants from each replication. Fodder quality traits, such as crude protein content (CP), crude fat content (CFT), crude fibre content (CFR) and ash content (ASH) were also estimated for all the hybrids.

The data were subjected to analysis of variance in accordance with the method recommended by Panse and Sukhatme (1985). Phenotypic variance (PV), phenotypic coefficient of variation (PCV), genotypic variance (GV) and genotypic coefficient of variation (GCV) were calculated according to the method suggested by Burton (1952). The formula provided by Allard (1960) was used to calculate heritability in the broad sense. Genetic advance was measured by using the formula given by Johnson *et al.* (1955).

Results and discussion

Analysis of variance for various green fodder yield and quality traits of pearl millet napier hybrids were presented in the Table1. The mean sum of square due to hybrids were significantly different for most of the traits recorded for study which revealed the presence of significant variability among the hybrids. Similar results in pearl millet napier hybrids were reported by Shalini *et al*. (2020) and Kumari *et al*. (2018).

The *per se* performance of hybrids were encapsulated in Table 2 and range were presented in Table 3. The average performance of GFY was 1331.29 g with a range of 140.32 to 2169.58 g. The mean values of various yield and fodder quality traits were : PH – 243.35 (ranged from 162.89 to 331.45) cm, NOT – 6.38 (ranged from 1.98 to 11.02), NOI – 10.67 (ranged from 3.96 to 26.90), NOL – 12.11 (ranged from 8.41 to 15.92) cm, LL – 81.80 (ranged

from 54.79 to 99.52) cm, LB – 2.86 (ranged from 2.30 to 3.86) cm, SG – 4.54 (ranged from 3.22 to 6.05) cm, LW – 794.80 (ranged from 65.13 to 1435.19) cm, SW – 425.45 (ranged from 65.13 to 731.68), L:S – 0.63 (ranged from 0.35 to 0.73), DMY – 248.21 (ranged from 31.12 – 393.59) g, DMC – 18.86 (ranged from 16.88 to 22.40) %. CP – 11.56 (ranged from 7.54 to 18.57) %, CFT – 5.50 (ranged from 2.19 – 7.16) %, CFR – 31.28 (ranged from 28.90 to 33.48) % and ASH – 6.35 (4.98 to 8.55) %.

Promising hybrids are those which devote to high green fodder yield. Among the hybrids, GP15074 × FD465, GP16016 × FD465, GP15073 × FD482, GP15073 × FD464, GP15073 × FD465 and GP15958 × FD482 possessed significantly higher mean values for green fodder yield. Besides GFY, the hybrid GP16016 × FD465 also shows significantly higher *per se* performance for 12 other traits such as PH, NOI, NOL, LL, LB, SG, LW, SW, L:S, DMY, CP and ASH. The hybrid GP15073 × FD482 recorded significant mean values for 11 traits other than GFY *viz*., PH, NOI, NOL, LL, SG, LW, SW, L:S, DMY, DMC and CFR.

The estimates of phenotypic variance (PV), genotypic variance (GV), phenotypic co-efficient of variation (PCV), genotypic co-efficient of variation (GCV), heritability (h^2), genetic advance (GA) and genetic advance as percent of mean (GAM) for green fodder yield and fodder quality traits of fifteen pearl millet napier hybrids were presented in the Table 2, Fig. 1 and Fig. 2.

Based on the analysis of the coefficient of variation in pearl millet napier hybrids, PV and PCV values were generally greater than GV and GCV values, indicating that environmental influence in the expression of all the traits under study. In the present study, the values of PCV and GCV for the traits ranged from 4.46% and 3.53% for crude fibre to 47.21% and 47.15% for leaf weight respectively. High PCV and GCV values were recorded by the trait LW (47.21% and 47.15%) followed by NOI (46.53% and 46.42%), GFY (42.85% and 42.80), DMY (41.68% and 41.53%), SW (39.66% and 39.50%), NOT (35.76% and 35.70%), CFT (26.08% and 25.92%) and CP (22.42% and 22.20%). Moderate PCV and GCV were observed in the traits NOL (19.69 and 19.51), SG (18.59 and 18.41), ASH (17.88 and 17.64), PH (17.60 and 17.40), LB (16.73 and 16.59), L:S (15.43 and 15.31) and LL (15.18 and 15.02). The characters DMC (8.82 and 8.55) and CFR (4.46 and 3.53) recorded low PCV and GCV values. High estimates of GCV and PCV for leaf length, number of tillers per plant, number of nodes per tiller, leaf stem ratio, dry matter yield and green fodder yield were reported by Kapoor (2020) in pearl millet napier hybrids, Kapoor (2017) in napier grass and Shankar (2002) in oat. Higher values of PCV and GCV for the traits such as LW, NOI, GFY, DMY, SW, NOT, CFT and CP suggests that there is significant, greater genetic variability in these traits which implies the suitability of these traits for direct selection of superior biomass yielding hybrids. For NOL, SG, ASH, PH, LB, L:S and LL, moderate PCV and GCV were recorded, indicating that selection for the aforementioned traits might result in identification of moderate performing hybrids. On the other hand, direct selection is limited by low PCV and GCV values for the traits DMC and CFR.

The hybris under study possessed high heritability for all the traits. Highest value was recorded by the character GFY (99.79%) followed by LW (99.72), NOT (99.65%), NOI (99.52%), DMY (99.28%), SW (99.20%), CFT (98.75%), L:S (98.51%), LB (98.33%), NOL (98.18%), CP (98.02%), SG (97.98%), LL (97.93%), PH (97.84%), ASH (97.31%), DMC (93.93%) and CFR (62.49%). High heritability of the traits indicates the minimal influence of

environment on expression of these traits suggesting these traits would be effective in locating superior hybrids.

The estimates of genetic advance as percent of mean were also high for all the traits except DMC (17.07%) and CFR (5.75%) which were moderate and low respectively. GAM was highest for LW (96.99%) followed by NOI (95.39%), GFY (88.09%), DMY (85.23%), SW (81.04%), NOT (73.41%), CFT (53.06%), CP (45.27%), NOL (39.81%), SG (37.53%), ASH (35.84%), PH (35.46%), LB (33.89%), L:S (31.30%) and LL (30.62%). It would be more effective to select traits with high heritability and genetic advance as that are mostly influenced by additive gene effects. Therefore, the traits PH, NOT, NOI, NOL, LL, LB, SG, LW, SW, L:S, DMY, CP, CFT, ASH and GFY with high heritability and genetic advance can be considered for direct selection of hybrids with enhanced green fodder yield coupled with fodder quality. High genotypic coefficient of variability, heritability and genetic advance for leaf weight, green fodder yield per plant, stem weight, crude fat content, number of leaves per plant and tillers per plant, plant height, crude protein content, and stem diameter were reported by Suthamathi and Dorairaj (1997) and Toor *et al*. (2017).

The hybrids showing superior performance for the traits with higher values of all the genetic parameters such as PCV, GCV, heritability and GAM were furnished in the Table 4. The hybrid GP15073 × FD465 expressed higher values of mean PCV, GCV, h^2 and GAM for the traits NOT, NOI, LW, SW, DMY, CP and GFY. Similarly, the hybrid GP16016 × FD465 showed higher values for NOI, LW, SW, DMY, CP and GFY. GP15073 × FD482 possessed significant values for NOI, LW, SW, DMY and GFY. Hence, these hybrids can be selected for further breeding program.

Conclusion

The green fodder yield contributing traits such as NOT, NOI, LW, SW, DMY and GFY and fodder quality traits such as CP and CFT were recorded higher values of PCV, GCV coupled with high estimates of heritability and genetic advance. These results demonstrated that direct selection based on variability, heritability and genetic advance of fodder yield contributing traits would help the breeder in identifying the elite hybrid with improved green fodder yield and quality. Among the hybrids, GP15073 × FD465 followed by GP16016 × FD465 exhibited significantly higher values for most of the above mentioned traits with high PCV, GCV, heritability and genetic advance and hence they could be tested over locations and seasons to assess their stability of yield and quality before commercialisation.

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Conflict of interest

The authors declare that they have no conflict of interest.

Reference

Allard, R. W. (1960). Principles of plant breeding. John Willey and Sons. *Inc. New York*, *485*.

Burton, G. W. (1952). Quantitative inheritance in grasses. *Pro VI Int Grassl Cong*, *1952*, 277-283.

Johnson, H. W., Robinson, H. F., & Comstock, R. E. (1955). Estimates of genetic and environmental variability in soybeans 1. *Agronomy journal*, *47*(7), 314-318.

Kapoor, R. (2017). Genetic variability and association studies in Napier grass (Pennisetum purpureum schumach.) for green fodder yield and quality traits. *Electronic Journal of Plant Breeding*, *8*(3), 885-891.

Kapoor, R. (2020). Variation and association studies for fodder yield and related traits in interspecific hybrids of bajra [*Pennisetum glaucum* (L.) R. Br.]× napier grass [*Pennisetum purpureum* (K.) Schum.]. *Range Management and Agroforestry*, *41*(2), 363-367.

Kumari, A., Sood, V. K., Devi, R., & Sharma, A. (2018). Genetic evaluation of different frost tolerant bajra-Napier hybrids for forage yield and quality traits in north western Himalayas. *The bioscan*, *13*(1), 77-84.

Lokhande, L.R. (2015). Selection indices for fodder yield and its components in bajra [*Pennisetum glaucum* (L.) R. Br.] x napier [*Pennisetum purpureum* (K) Schum] hybrid. M.Sc. thesis, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra.

Panse, V. G., & Sukhatme, P. V. (1985). Statistical methods for agricultural workers (p. 47). *New Delhi: ICAR*.

Satapute, S. M., Mali, A. R., & Jibhakate, P. P. (2014). Genetic analysis of forage yield and its component traits in bajra x Napier hybrids. *Forage Research*, *40*(2), 106-108.

Shalini, P., Surana, P., & Shinde, G. (2020). Development and evaluation of new bajra× napier grass hybrids for green fodder yield and quality traits. *Forage Reearch.*, *45*(4): 281-284.

Shankar S., Jha B., Ghosh J. & Nirala R.B.P. (2002). Variation and association studies in oat (*Avena sativa* L.) *Forage. Research*, 28(2): 110-112.

Suthamathi, P., & Dorairaj, M. S. (1997). Genetic variability in napier grass (*Pennisetum purpureum*. (K.) Schum). *Indian Journal of Genetics and Plant Breeding*, *57*(03): 319-321.

Toor, A.K., Kumar, A. and Kapur, R. (2017). Evaluation of napier bajra hybrids for yield and other parameters. *International Journal of Genetics*, *9*(7): 287-290.

Table 1. Anova for various green fodder yield and quality traits

Source	Replication	Genotypes	Error
Df	**1**	**14**	**14**
PH	0.0472	3627.3137**	39.6262
NOT	0.0034	10.3919**	0.0182
NOI	0.0003	49.1437**	0.1188
NOL	0.0168	11.2545**	0.1035
LL	0.9363	305.2124**	3.1900
LB	0.0003	0.4551	0.0038
SG	0.0006	1.4099	0.0144
LW	53.8146	281241.6531**	392.6378
SW	304.5177	56706.5783**	227.0751
L:S	0.0001	0.0187	0.0001
DMY	5.2836	21324.5138**	77.2323
DMC	0.2960	5.3727**	0.1683
CP	0.0015	13.3055**	0.1329
CFT	0.0028	4.0839**	0.0256
CFR	0.2219	3.1688*	0.7316
ASH	0.0015	2.5439*	0.0347
GFY	161.7506	650153.2130**	683.2155

PH – plant height, NOT - number of tillers per plant, NOI - number of internodes per tiller, NOL - number of leaves per tiller, LL - leaf length, LB - leaf breadth, SG - stem girth, LW - leaf weight, SW - stem weight, L:S - leaf to stem ratio, DMY - dry matter yield per plant, DMC - dry matter content, CP - crude protein, CFT - crude fat, CFR - crude fibre, ASH - ash content and GFY - green fodder yield per plant.

* significant at 5% level, ** significant at 1% level

Table 2. *Per se* performance of pearl millet napier hybrids for various green fodder yield and quality traits

Entries	PH	NOT	NOI	NOL	LL	LB	SG	LW	SW	L:S	DMY
GP15074 × FD482	240.29	7.90**	12.30**	15.92**	86.89**	3.26*	3.92	522.95	401.02	0.57	167.35
GP15074 × FD464	189.85	6.65	8.97	10.44	75.54	2.36	3.54	366.00	270.49	0.57	137.53
GP15074 × FD465	281.04**	11.02**	10.27	12.79	85.46	3.45*	4.77	1196.07**	731.68**	0.63	356.36**
GP16016 × FD482	267.94**	6.54	10.96	14.76**	93.49**	2.99	5.45**	716.62	552.59**	0.57	273.38*
GP16016 × FD464	162.89	1.98	3.96	9.97	84.41	2.49	4.36	33.48	65.13	0.35	31.12
GP16016 × FD465	331.45**	5.36	12.44**	15.28**	99.52**	3.62*	6.05**	1357.71**	497.40**	0.73**	371.84**
GP15073 × FD482	291.36**	5.93	11.66*	13.04**	88.85**	2.86	5.83**	1068.38**	546.49**	0.67**	345.16**
GP15073 × FD464	254.85	3.79	10.04	12.54	82.84	2.67	5.12**	1435.19**	611.86**	0.69**	393.59**
GP15073 × FD465	227.78	7.74**	26.90**	11.07	84.09	2.56	4.36	955.79**	521.45**	0.65**	327.61**
GP15958 × FD482	267.65**	6.20	9.02	10.86	69.45	2.82	3.99	905.41**	379.61	0.72**	255.01
GP15958 × FD464	236.71	4.75	9.15	15.57**	97.89**	3.86**	5.15**	711.13	504.56**	0.59	248.91
GP15958 × FD465	219.48	9.09**	7.84	9.82	54.79	2.53	3.22	765.14	312.64	0.72**	195.46
GP15988 × FD482	257.97	5.51	9.05	10.39	74.99	2.69	3.82	487.81	223.16	0.69**	136.01
GP15988 × FD464	212.27	4.54	9.72	10.78	85.60	2.51	4.49	654.44	420.39	0.62	200.69
GP15988 × FD465	208.77	8.71**	7.74	8.41	63.28	2.30	4.12	745.95	343.31	0.69**	283.22**
Grand mean	243.35	6.38	10.67	12.11	81.80	2.86	4.54	794.80	425.45	0.63	248.21
CV(%)	2.59	2.11	3.23	2.66	2.18	2.16	2.64	2.49	3.54	1.88	3.54
CD (5%)	13.53	0.29	0.74	0.69	3.84	0.13	0.26	42.60	32.40	0.03	18.89
CD(1%)	18.76	0.40	1.03	0.96	5.32	0.18	0.36	59.05	44.91	0.04	26.19

PH – plant height, NOT - number of tillers per plant, NOI - number of internodes per tiller, NOL - number of leaves per tiller, LL - leaf length, LB - leaf breadth, SG - stem girth, LW - leaf weight, SW - stem weight, L:S - leaf to stem ratio, DMY - dry matter yield per plant, DMC - dry matter content, CP - crude protein, CFT - crude fat, CFR - crude fibre, ASH - ash content and GFY - green fodder yield per plant.

* significant at 5% level, ** significant at 1% level

Table 3. Estimates of genetic parameters of pearl millet napier hybrids for various green fodder yield and quality traits

S.No.	Traits	Grand Mean	Range		PV	GV	PCV	GCV	h^2	GA	GAM
			Low	High							
1.	PH	243.35	162.89	331.45	1833.47	1793.84	17.60	17.40	97.84	86.30	35.46
2.	NOT	6.38	1.98	11.02	5.21	5.19	35.76	35.70	99.65	4.68	73.41
3.	NOI	10.67	3.96	26.90	24.63	24.51	46.53	46.42	99.52	10.17	95.39
4.	NOL	12.11	8.41	15.92	5.68	5.58	19.69	19.51	98.18	4.82	39.81
5.	LL	81.80	54.79	99.52	154.20	151.01	15.18	15.02	97.93	25.05	30.62
6.	LB	2.86	2.30	3.86	0.23	0.23	16.73	16.59	98.33	0.97	33.89
7.	SG	4.54	3.22	6.05	0.71	0.70	18.59	18.41	97.98	1.70	37.53
8.	LW	794.80	33.48	1435.19	140817.15	140424.51	47.21	47.15	99.72	770.87	96.99
9.	SW	425.45	65.13	731.68	28466.83	28239.75	39.66	39.50	99.20	344.79	81.04
10.	L:S	0.63	0.35	0.73	0.01	0.01	15.43	15.31	98.51	0.20	31.30
11.	DMY	248.21	31.12	393.59	10700.87	10623.64	41.68	41.53	99.28	211.56	85.23
12.	DMC	18.86	16.88	22.40	2.77	2.60	8.82	8.55	93.93	3.22	17.07
13.	CP	11.56	7.54	18.57	6.72	6.59	22.42	22.20	98.02	5.23	45.27
14.	CFT	5.50	2.19	7.16	2.05	2.03	26.08	25.92	98.75	2.92	53.06
15.	CFR	31.28	28.90	33.48	1.95	1.22	4.46	3.53	62.49	1.80	5.75
16.	ASH	6.35	4.98	8.55	1.29	1.25	17.88	17.64	97.31	2.28	35.84
17.	GFY	1331.29	140.32	2169.58	325418.21	324735.00	42.85	42.80	99.79	1172.67	88.09

PV – phenotypic variance, GV - genotypic variance, PCV - phenotypic co-efficient of variation, GCV - genotypic co-efficient of variation, h^2 - heritability, GA - genetic advance and GAM - genetic advance as percent of mean.
PH – plant height, NOT - number of tillers per plant, NOI - number of internodes per tiller, NOL - number of leaves per tiller, LL - leaf length, LB - leaf breadth, SG - stem girth, LW - leaf weight, SW - stem weight, L:S - leaf to stem ratio, DMY - dry matter yield per plant, DMC - dry matter content, CP - crude protein, CFT - crude fat, CFR - crude fibre, ASH - ash content and GFY - green fodder yield per plant.
* significant at 5% level, ** significant at 1% level

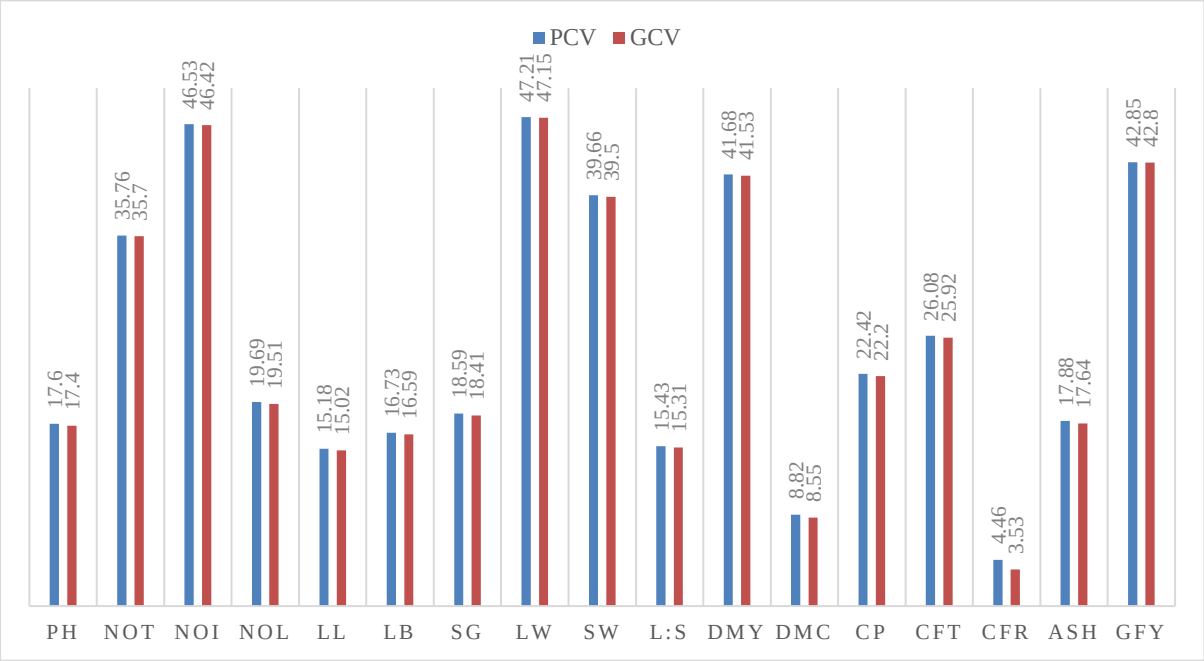

Fig. 1 Co-efficient of variation for various green fodder yield and quality traits

PCV - phenotypic co-efficient of variation and GCV - genotypic co-efficient of variation.
PH – plant height, NOT - number of tillers per plant, NOI - number of internodes per tiller, NOL - number of leaves per tiller, LL - leaf length, LB - leaf breadth, SG - stem girth, LW - leaf weight, SW - stem weight, L:S - leaf to stem ratio, DMY - dry matter yield per plant, DMC - dry matter content, CP - crude protein, CFT - crude fat, CFR - crude fibre, ASH - ash content and GFY - green fodder yield per plant.

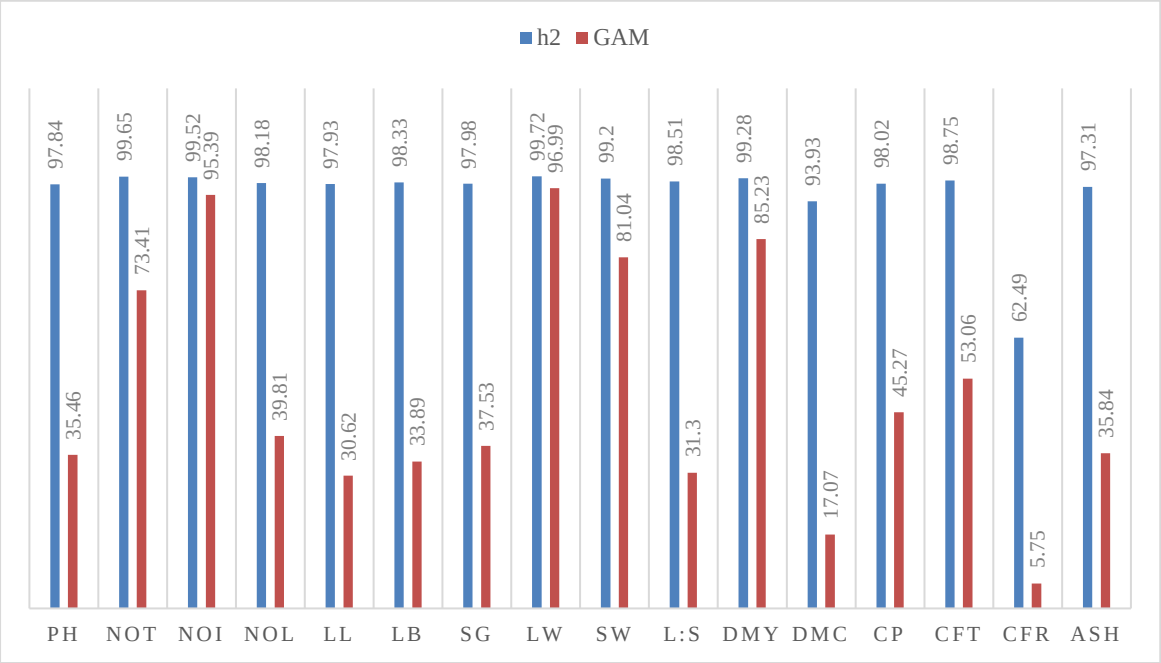

Fig. 2 Heritability and genetic advance as percent of mean for various green fodder yield and quality traits

h^2 - heritability, GA - genetic advance and GAM - genetic advance as percent of mean.
PH – plant height, NOT - number of tillers per plant, NOI - number of internodes per tiller, NOL - number of leaves per tiller, LL - leaf length, LB - leaf breadth, SG - stem girth, LW - leaf weight, SW - stem weight, L:S - leaf to stem ratio, DMY - dry matter yield per plant, DMC - dry matter content, CP - crude protein, CFT - crude fat, CFR - crude fibre, ASH - ash content and GFY - green fodder yield per plant.

Table 4. Hybrids with significant mean performance and higher values of other genetic parameters for various green fodder yield and quality traits

Hybrids	Mean	PCV and GCV	h^2 and GAM	Mean, PCV, GCV, h^2 and GAM
GP15073 × FD465	NOT, NOI, LW, SW, L:S, DMY, DMC, GFY and CP	NOT, NOI, LW, SW, DMY, CP and GFY	NOT, NOI, LW, SW, L:S, DMY, CP and GFY	NOT, NOI, LW, SW, DMY, CP and GFY
GP16016 × FD465	PH, NOI, NOL, LL, LB, SG, LW, SW, L:S, DMY, CP and ASH	NOI, LW, SW, DMY, CP and GFY	GFY, LW, NOI, DMY, SW, L:S, LB, NOL, CP, SG, LL, PH and ASH	NOI, LW, SW, DMY, CP and GFY
GP15073 × FD482	PH, NOI, NOL, LL, SG, LW, SW, L:S, DMY, DMC and CFR	NOI, LW, SW, DMY and GFY	GFY, LW, NOI, DMY, SW, L:S, NOL, SG, LL, PH, DMC and CFR	NOI, LW, SW, DMY and GFY

PCV - phenotypic co-efficient of variation, GCV - genotypic co-efficient of variation, h^2 - heritability and GAM - genetic advance as percent of mean.
PH – plant height, NOT - number of tillers per plant, NOI - number of internodes per tiller, NOL - number of leaves per tiller, LL - leaf length, LB - leaf breadth, SG - stem girth, LW - leaf weight, SW - stem weight, L:S - leaf to stem ratio, DMY - dry matter yield per plant, DMC - dry matter content, CP - crude protein, CFT - crude fat, CFR - crude fibre, ASH - ash content and GFY - green fodder yield per plant.