SHARMA, S.C. and SINGH, H.G. 1973. Effects of levels of nitrogen and placements of phosphate on the quality of forage. Madras Agric. J., 60(8) : 781-785.

TIEDJENS, V.A and WALL.M.E. 1938. The importance of Potassium in the growth of Vegetable plants. Proc. Amer. Soc. Hort. Sci. 36 : 740-743.

Madras Agric. J., 81(6): 302-305 June, 1994

https://doi.org/10.29321/MAJ.10.A01519

GENETIC ANALYSIS OF FOODER YIELD AND QUALITY CHARACTERS IN SORGHUM (*Sorghum bicolor* (L) Moench)

R.SANKARAPANDIAN, N.SUBBARAMAN and A.AMIRTHADEVARATHINAM.
School of Genetics, TNAU, Coimbatore.

ABSTRACT

Three lines were crossed with fourteen testers and resultant fortytwo hybrid combinations and their parents were evaluated for combining ability for fodder yield and their component characters. Observations were recorded on fodder yield and quality characters. Non-additive gene action was predominent for all the characters except for palnt height. Among the lines, 2077 A expressed its superior *per se* performance for plant height, number of leaves, total soluable solids crude protein yield and dry matter production M 35-1 and K7 showed its superiority in *gca* effects, *sca* effects, the crosses 2077 A x FS 35-1, 2077 A x FS 1, 2219 A x FS1 and 2219 A x 35-1 were best. On the basis of gene action and combining ability appropriate improvement programme for the traits associated with fodder yield has been suggested.

Sorghum is cultivated mainly to obtain grains for human consumption and fodder as a cattle feed. In other countries like USA. Brazil, sweet fodder sorghums are used for syrup and alcohol and in African countries they are also used for forage and silage. Studies by Ross *et al.*, (1983) demonstrated that improvement of fodder traits by breeding for a genotype that combines the good fodder traits will be of much value. The nature of breeding system, breeding value of the population handled, genetic basis of the trait and the methods of selection will greatly aid the breeder in his task. The analysis was carried out to assess the breeding value of the selected parents,, combining ability and gene action for each of the characters.

MATERIALS AND METHODS:

The sorghum materials chosen for the present study consisted of three lines and fourteen testers. All the hybrids and parents were raised in a randomised block design replicated three times. The experiment was carried out at the Agricultural Research Station, Kovilpatti during rabi season of 1985. Observarions were recorded on six characters and data were analysed separately for the combining ability thorugh line x tester method of analysis developed by Kempthorne (1957). The analysis of variance and mean square expectation were worked out *(Rao et al.* 1968).

RESULTS AND DISCUSSION

Analysis of variance showed significant differences among hybrids, lines, testers and line x tester were significant for all the characters studied (Table 1). The estimation of vaiance due to general and specific combining ability revealed that specific combining ability effects were higher for

Table 1. Analysis of variance.

Source	DF	Plant height	Number of leaves	Leaf shoot ratio	Total soluble solids (TSS)	Crude protein	Dry matter production
Replication	2	143.5	0.11	4.61	0.88	4.493	2.14
Hybrids	41	5189.9**	6.88**	290.06**	64.88**	57.590**	5369.72**
Line	2	5890.0**	56.10**	187.10**	175.15**	260.290**	29886.82**
Tester	13	14018.2**	6.15**	583.5**	31.23**	88.940**	5453.76**
Line x Tester	26	721.9**	3.46**	151.3**	48.23**	26.470**	3441.78**
Error	116	49.1	0.02	22.3	0.27	1.850	119.20
σ^2 GCA		362.04	1.08	9.17	2.15	5.79	557.98
σ SCA		224.3	1.37	43.00	15.98	8.31	1108.10
σ GCA : SCA		1.11 : 1	0.79 : 1	0.21 : 1	0.13 : 1	0.69 : 1	0.51 : 1

* Significant at five per cent level **Significant at one per cent level

Table 2. Mean performance and general combining ability effects in sorghum.

Line / Tester	Plant height		Number of leaves per plant		Leaf-shoot ratio %	
	Per se	gca effect	Per se	gca effect	Per se	gca effect
Lines						
2219 A	82.26	14.03**	8.00	1.15**	9.73	2.46*
3660 A	138.60	11.54**	10.06	0.22**	7.25	1.75
2077 A	123.00	2.49	13.06	1.37**	10.65	0.71
SE	4.04	1.08	0.08	0.02	0.18	0.72
Testers						
SPV 462	187.06	13.29	11.00	0.07	5.88	4.11
SPV 472	194.40	1.37	8.93	1.35	4.59	4.22
SPV 475	165.00	47.35**	11.93	1.28**	7.28	21.22**
SPV 544	150.13	49.73**	11.82	0.28**	7.87	1.77
KS 6312	143.30	47.97**	10.00	0.68**	6.97	7.22**
KS 7078	136.40	62.75**	11.13	0.01	8.16	1.77
Co 23	149.80	2:08	10.86	0.38**	7.25	2.14
K 4	197.80	6.64*	9.00	0.69**	4.55	5.66*
Co 25	246.00	19.46**	10.93	0.35**	4.44	2.89
M 35-1	277.53	29.97**	13.08	1.43**	4.71	10.44**
K 3	279.00	56.51**	8.93	1.16**	3.20	0.44
K 7	330.73	54.51**	12.06	0.34**	3.64	9.77**
FS 1	286.46	40.81**	9.13	0.69**	3.19	5.77**
Co 11	248.06	3.86	7.93	1.35**	3.20	5.44*
SE	4.04	2.33	0.08	0.55	0.18	1.57

Line / Tester	Total soluble solids at maturity %		Crude protein yield / plant %		Dry matter production per plant (g)	
	Per se	gca effect	Per se	gca effect	Per se	gca effect
Lines						
2219 A	4.72	2.31**	3.10	2.91**	68.33	29.77**
3660 A	5.28	1.21**	10.14	0.46	131.00	7.44**
2077 A	11.50	1.10**	8.58	2.45	139.00	22.33**
SE	0.30	0.08	0.78	0.20	6.30	1.68
Testers						
SPV 462	17.59	3.21**	7.80	3.12**	108.30	41.81**
SPV 472	17.32	2.18**	4.20	0.36	78.30	28.18**
SPV 475	17.62	3.20**	10.13	1.98**	126.30	17.93**
SPV 544	4.79	2.25**	10.90	0.20	126.65	18.59**
KS 6312	5.61	2.38**	12.56	3.34**	155.83	8.26
KS 7078	12.14	6.38**	4.04	4.25**	138.30	30.17**
Co 23	14.32	1.71**	7.84	0.12	79.15	13.18
K 4	4.73	2.74**	3.26	1.75**	81.65	1.81
Co 25	16.08	1.68**	9.46	1.75**	153.30	7.62
M 35-1	16.55	3.31**	6.14	7.41**	113.30	41.50**
K 3	7.67	1.44**	2.79	0.17	86.65	7.37
K 7	17.73	1.12**	13.37	4.74**	182.50	40.95**
FS 1	15.00	3.51**	5.04	1.33**	108.30	14.59**
Co 11	11.04	0.11	9.12	1.66*	126.65	6.38
SE	0.30	0.17	0.78	0.45	6.30	3.63

* Significant at five per cent level **Significant at one per cent level

all characters except for plant height (Table 1). Mean performance and general combining ability effects for female and males are presented in Table 2.

Plant Height

The signifinance of lines and testers showed their variability and the influence of additive gene action (Table 1). Considering both direction and magnitude of *gca* effects anfd their *per se* performance, the parents namely 3660 A, Co 25, M 35-1, K 3 and FS 1 could be advantageous for plant height (Table 2). The hybrid 3660 A x Co 25 (287.13cm ; 14.02*) showed high *per se* performance. In the present study, it is evident that by pedigree breeding, the plant height could be increased for which Co 25 and 3660 A could be desirable parents. Rao (1970) pointed out that crosses where specific effects are low, could be utilized for conventional breeding programme, provided the two parents entering the cross individually show high *gca* effects. The cross combinations namely 3660 A x SPV 475 (222.60cm 16.11 **) and 2077 A x FS 1 (304.26cm ; 18.66***) combined with one good and one poor general combiners could produce desirable transgressive segregants of the additive genetic system present in the good combiner and conventional breeding methodology is helpful for obtaining desirable segregants.

Number Of Leaves Per Plant :

The variance ratio indicated non-additive gene action was more important. Among the parents, 2077 A, Co 25, M 35-1, K 7 and Co 11 were the best general combiners for number of leaves per plant (Table 2). The hybrid namely 2077 A x Co 25 (13.06 ; 0.36 **) exhibited high *per se* performance. Hence, these parents appear to be worthy of exploitation in varietal improvement programme. The hybrids namely 3660 A x FS 1 (10.93 ; 0.85**) and 3660 A x Co 11 (14.13 ; 2.03**) involved either with one good and one poor combiner or both poor combiners exhibiting significant *sca* effects.

Leaf Shoot Ratio

Non-additive gene action is predominant for this tract. This findings is in accordance with Boora and Lodhi, (1981). Among the parent 2219 A, SPV 475 and KS 6312 were good general combiners for leaf-shoot ratio. Four hybrid combination namely 3660 A x SPV 472, 3660 A x SPV 475, 2077 A x Co 25 and 2077 A x Fs 1 showed positive and significant *sca* effects who's parents were good X poor and poor X poor general combiners which also *per se* performance (Table 1) can be utilized in the varietal improvement programme. These combinations would give desirable transgressive segregates in the later generations.

Total Soluble Solids (TSS) At Maturity

This trait is expressed as degree and includes sugars, starch, resins, gums and 'N' compounds. Preponderance of non-additive gene effects in controlling for this trait was evident. Among the parents 3660 A, K 7 and FS 1 were the best general combiners exhibited high *per se* performance indicating the additive gene effects of the parents. The hybrids involved both good general combiners Co 25, K 3 and Co 11 (1.09 to 17.94 ; 0.89* to 5.18**) showed significant *sca* effect.

Crude Protein Yield Per Plant

Higher magnitude of *sca* variance than *gca* variance was evidenced by the *gca* : *sca* ratio (Table 1). Similar report was made by Gopalan (1983). Among the parents 2077 A, M 35-1, K 7 and Co 11 were the best general combiners. The hybrids namely 2077 A x K 4 (15.47 ; 2.32*) 2077 A x Co 1 (16.91 ; 3.85 **) which involved both good general combiners showed significant *sca* effects and high *per se* performance was recorded by 3660 A x M 35-1 (20.81 ; 3.99,**).

Dry Matter Yield Per Plant

One of the objectives of the present study was to obtain a single genotype with grain yield for consumption and a large out put of stalk that can be utilised as animal feed. Since *sca* variance was higher than *gca* variance (Table 1), major role of non- additive gene action governing this character. The parents namely 2077 A, SPV 472, M35-1 and K7 are the best general combiners for this trait (Table 2). Considering both direction and magnitude of *gca* effects and the hybrids *per se* performance, the parents 2077 A and M 35-1 could be the most advantageous for dry matter production.

REFERENCES

BOORA, K.S. and LODHI G.P. 1981. Combining ability in forage sorghum. Forage Res. 7 : 19-25

GOPALAN, A.1983. Studies on combining ability of forage characters in Pennisetum americannum (L) Lecke, Ph.D., Thesis. Tamil Nadu Agricultural University, Coimbatore.

KEMPTHORNE, O. 1957. An introdution to genetic statistics. John Wiley and Sons. Inc, New york.

RAO, N.G.P. 1970. Genetic analysis of some exotic x indian crosses in Sorghum. II. Combining ability and components of genetic variation. Indian J. Genet., 30 : 362-376.

RAO, N.G.P., RANA.V.K.S, and TRIPATHI,D.P, 1968. Line x tester analysis of combining ability in sorghum. Indian J. Genetc., 28 : 231-238.

Madras Agric. J., 81(6): 305-308 June, 1994

INTER RELATIONSHIP BETWEEN DIFFERENT PHOSPHORUS FRACTION IN A CROPPING SEQUENCE TREATED WITH DIFFERENT PHOSPHORUS SOURCES.

P.SINGARAM and G.V.KOTHANDARAMAN,
Department of Soil Science, TNAU, Coimbatore

ABSTRACT

The inter relationship between different fractions of phosphorus was studied in the soils of a cropping sequence (Fingermillet - Maize - Blackgram) treated with different phosphorus sources. The available P (Olsen's P) is positively related with Saloid-P and Al- P. The positive relationship of Fe-P with available P existed in the first two crops vanished in the third crop. The RS-P is not dependent on the available P. Over a period of time Ca-P is also having positive relationship with available P and Al-P.

It has been observed that normally more than one form of P play a significant role in P nutrition of a crop. Potential advantage of P management on a cropping sequence allows the distribution of P among the component crops according to their responsiveness to different forms of P. With this in view, a study was undertaken to find out the inter-relationship betwen different P fractions and crops in a cropping sequence treated with different P sources.

MATERIALS AND METHODS

A field experiment was carried out to evaluate different sources of P for cereal based cropping sequence of fingermillet - maize - blackgram at Tamil Nadu Agricultural University Farm, Coimbatore. The experiment was laid out in F RBD design with three replications. The nutrient status of the clay loam soil (Typic ustropept) was low, low and high for N,P, and K, respectively with a pH of 8.02. The experiment involved 16 treatments with five sources of P viz. single superphosphate, rockphosphate,2/3 rock phosphate + 1/3 single super phosphate, rock phosphate + Phospho bacterium (*Bacillus megaterium*) and Diammonium phosphate and three levels of P viz. 30, 60 and 90 kg P_2O_5 ha^{-1} along with an absolute control. Phosphatic fertilizers were applied only to fingermillet to study it's direct effect, residual effect on the succeeding crop of maize and second residual effect on the third crop of blackgram, To

Table 1. Correlation matrix between different P fractions - Fingermillet.

Variable	Saloid - P	Al - P	Fe - P	RS - P	Ca - P	Avail.P_1	Avail.P_2
	X_1	X_2	X_3	X_4	X_5	X_6	X_7
X_1	-	0.280	0.052	0.114	0.171	0.365*	0.672**
X_2		-	-0.087	0.150	-0.105	0.004	0.329*
X_3			-	-0.151	0.523**	0.091	0.214
X_4				-	-0.006	-0.175	0.218
X_5					-	0.040	0.251
X_6						-	0.216
X_7							-

* Significant at 5% probability level **Significant at 1% probability level

Avail. P_1 : Available P at tillering stage Avail. P_2 : Available P at flowering stage