Jour. Ind. Soc. Ag. Statistics
45(2), 1993 : 219-225

Screening of Dose-Response Relationships Through Different Green Leaf Materials in Sorghum

G.R. Maruthi Sankar, G. Subba Reddy,
B. Venkateswarlu and J.C. Katyal
Central Research Institute for Dryland Agriculture, (ICAR), Hyderabad, 500 659.
(Received : September, 1991)

Summary

Green Leaf Manuring (GLM) trails under pot conditions on sorghum were conducted for testing nitrogen (N) dose-response relations through 5 sources. Correlation analysis of grain yield (GY) with leaf area (LA), earhead drymatter (ED), test weight (TW), total drymatter (DM), nitrogen uptake (UN) and applied N (FN) indicated positive and significant relation among all pairs of variables studied except TW with other variables. Correlations varied from 0.49 to 0.97. Estimates of prediction and the optimal FN varied from 51 to 124 kg/ha under dryland conditions.

Key Words : Correlations, Optimization, Multiple Range Test.

Introduction

An attempt has been made to study the relationships of N through 5 sources with different crop variables and optimize N for high sorghum production under drylands, based on Green Leaf Manuring (GLM) trials under pot conditions at CRIDA during 1986 and 1987. The soil with loam sand texture (pH 6.8, O.C.% 0.5, Soil N 172 kg/ha, Soil P 10 kg/ha) was filled in 30 kg plastic pots. The compound leaves and small twigs of Leaucaena (LE-N), Sesbania (SE-N), Glyricidia (GL-N), Pearlmillet (PM-N) straw equivalent to 20, 40 and 80 kg N/ha were powered and incorporated in pots by mixing in 10 cm soil layer. Urea was applied as a fifth source in other treatments. Pots which did not receive either organics or urea served as control pots. Phosphorus (P) @ 30 kg/ha was applied in all pots. Five seeds of sorghum (CSH-6) was sown in each pot but finally only 3 plants with 5 replications were maintained. Observations on GY, LA, ED, DM, TW and UN were recorded at harvest of the corp.

Correlations of GY, LA, ED, DM, TW, UN and FN variables were estimated which formed a basis for screening variables for modeling and optimising N. Regressions of each variable on FN were derived for studying N effects as

$$Y = A + B_1FN + B_1FN^2 + \text{error term} \qquad (1)$$

with standard regression methodology. The regression estimates along with standard errors were used for N optimization.

2. *Results and Discussion*

A wide range was observed in all variables. Minimum values occured under PM–N and maximum values occured under LE–N sources. The variation was due to different N sources and high response of sorghum to N application. The responses increased at a decreasing rate at different N levels. Table 1 gives range, mean, standard deviation and coefficient of variation of variables. Analysis of variance of variables indicated that N sources and variables differed significantly from each other. The N sources were found to be preferable in the order LE–N, UR–N, SE–N, GL–N and PM–N based on Duncan's Multiple Range test.

Estimates of correlation were derived among all pairs of variables which were high and significant except between TW and other variables. The correlations ranged from 0.49 to 0.97 and were high under LE–N and UR–N when compared to other sources. FN had a high and significant correlation with all other variables.

Estimates of regression of all variables on FN were derived under each source which indicated a nonlinear trend of response to N. The type of response was (+) under all models except ED models under LE–N and SE–N where it was (++) for linear quadratic terms. Estimates of R^2 were high and significant and ranged from 0.67 to 0.95 under LE–N, 0.69 to 0.97 under SE-N, 0.58 to 0.95 under GL-N, 0.50 to 0.94 under UR-N, and 0.29 to 0.69 under PM–N sources.

Estimates of error ($\hat{\sigma}$) were least for GY (1.27) and TW (0.81) under LE–N, for LA (33.72), DM (2.9) and UN (12.41) under SE–N, and ED (1.38) under PM-N. Out of 30 regressions, 21 linear and 12 quadratic terms were significant for prediction. The expected values were highest for GY (28.39), ED (32.86), LA (1674.06) and UN (193.68) under LE-N and DM (53.55 and TW (27.54) under GL-N models.

Estimates of Optimal N doses were meaningful only under 15 models, and were extrapolated in other models. Optimal N varied from 60 (PM–N) to 96 kg/ha (UR–N) for maximum GY, 80 (SE–N) to 124 kg/ha (PM-N) for LA, 57 (UR-N) to 99 kg/ha (GL-N) for ED, 39 (PM–N) to 123 kg/ha (SE–N) for DM, 51 (LE–N) to 123 kg/ha GL-N for TW, and 67 (PM-N) to 117 kg/ha (SE-N) for UN respectively. Estimates of different parameters are given in Table 2. The doses have varied depending on N source efficiency and the study has indicated that one can make prediction and optimisation of variables with different sorghum variables under dryland conditions.

REFERENCES

[1] Reddy, G. Subba, Venkateswarlu B. and Vittal, K.P.R., 1991(a). "Effect of substitution of fertilizer nitrogen with subabool (Leaucaena Leaucocephala) leaves on growth and yield of rainfed sorghum (Sorghum bicolor) in an alfisol", *I. J. Agric. Sci.*, **61(5)**, 316-319.

[2] Reddy, G. Subba, Venkateswarlu, B., Vittal, K.P.R., and Maruthi Sankar, G.R. 1991(b). "Effect of different organic materials as source of nitrogen on growth and yield of sorghum (Sorghum bicolor)", *I. J. Agric. Sci.*, **61(8)**

Table 1. Yield and other crop variables under different GLM sources

Variables		LE-N	SE-N	GL-N	UR-N	PM-N	Pooled
GY	(a)	14.8-30.0	12.2-28.4	14.7-29.9	11.6-28.4	6.5-13.3	6.5-13.3
	(b)	22.6	21.2	19.3	22.6	9.8	19.1
	(c)	5.3	5.1	5.5	4.9	1.9	6.7
	(d)	23.4	24.2	28.3	21.7	19.6	35.2
LA	(a)	1100-1712	955-1421	1206-1646	1016-1495	611-886	611-1712
	(b)	1304.1	1199.6	1247.1	1390.3	719.5	1172.1
	(c)	205.0	179.4	169.2	195.1	92.3	291.8
	(d)	15.7	14.9	13.5	14.0	12.8	24.9
ED	(a)	17.1-36.9	14.7-57.7	14.1-33.5	12.8-29.2	6.1-14.3	6.1-36.9
	(b)	24.7	22.0	20.4	21.8	11.6	20.1
	(c)	6.6	5.9	5.5	5.1	2.3	6.9
	(d)	26.5	26.7	27.1	23.3	20.0	34.4

DM	(a)	34.1–62.0	29.2–57.7	27.7–56.1	26.4–53.9	14.9–35.9	14.9–62.0
	(b)	46.8	41.2	40.8	46.8	31.7	41.5
	(c)	7.8	6.1	7.9	6.5	4.5	8.7
	(d)	16.6	14.8	19.4	13.9	14.3	20.9
TW	(a)	23.2–28.3	21.6–27.6	21.9–28.2	20.6–26.8	16.9–25.5	16.9–28.3
	(b)	24.8	24.1	23.8	24.9	21.2	23.8
	(c)	1.3	1.4	1.7	1.8	2.4	2.2
	(d)	5.1	5.8	7.2	7.3	11.1	9.4
UN	(a)	78.2–218.8	72.8–176.9	76.8–201.8	61.8–169.8	39.9–166.4	39.9–218.8
	(b)	141.5	122.0	117.0	130.1	61.6	116.2
	(c)	42.5	33.1	36.9	38.7	15.7	45.1
	(d)	30.0	27.1	31.5	27.8	25.4	38.8

a. Range b. Mean c. Standard deviation d. Coefficient of Variation (%)

Table 2. Estimates of regression coefficients, R^2, Error ($\hat{\sigma}$), Expected Values and Optimal N doses under different GLM sources

Dep.	Var	A	B_1	B_2	R^2	$\hat{\sigma}$	CV (%)	Opt. N	Exp. Y
GY	(L)	3.9*	0.699**	-0.005**	0.95**	1.27	5.6	70	28.4
GY	(S)	3.9	0.641**	-0.005**	0.89**	1.80	8.5	70	26.7
GY	(G)	5.1*	0.671**	-0.005**	0.87**	1.89	8.4	67	27.6
GY	(U)	6.3	0.404*	-0.002	0.81*	2.56	13.2	96	25.8
GY	(P)	3.3	0.286**	-0.002*	0.46*	1.52	15.5	60	11.8
LA	(L)	876.7**	14.748**	-0.068*	0.95**	46.70	3.4	108	1674.1
LA	(S)	655.6**	18.656**	-0.117**	0.97**	33.72	2.8	80	1401.9
LA	(G)	906.7**	14.591**	-0.071*	0.95**	45.62	3.3	103	1661.7
LA	(U)	849.6**	11.541**	-0.050	0.94**	42.65	3.4	114	1510.3
LA	(P)	570.1	4.226	-0.017	0.48*	71.04	9.9	124	831.1
ED	(L)	17.1**	0.053	0.002	0.92**	2.02	8.2	80	32.9
ED	(S)	15.7**	0.015	0.002	0.93**	1.64	7.4	80	29.7
ED	(G)	9.8**	0.398**	-0.002	0.90**	1.71	7.8	99	29.5
ED	(U)	10.3**	0.229*	-0.002	0.91**	1.76	8.6	57	16.9
ED	(P)	4.2*	0.286**	-0.002	0.69**	1.38	11.9	68	13.9

DM	(L)	29.8**	0.483*	–0.003	0.86**	3.05	6.5	121	50.2
DM	(S)	28.6**	0.369	–0.002	0.80**	2.90	7.0	123	51.2
DM	(G)	26.2**	0.762**	–0.005*	0.84**	2.90	6.2	72	53.5
DM	(U)	27.9**	0.313	–0.002	0.65**	5.01	12.3	104	44.3
DM	(P)	29.6**	0.273	–0.004	0.37*	4.00	12.6	39	34.9
TW	(L)	19.5**	0.275**	–0.003**	0.67**	0.81	3.3	51	26.5
TW	(S)	20.2**	0.154*	–0.001	0.69**	0.86	3.6	70	25.6
TW	(G)	21.5**	0.098	–0.001	0.58**	1.27	5.1	123	27.5
TW	(U)	19.6**	0.153	–0.001	0.50**	1.29	5.4	76	25.4
TW	(P)	13.9**	0.346*	–0.003*	0.31*	2.11	10.0	54	23.3
UN	(L)	33.5	3.396**	–0.018	0.89**	14.84	10.5	94	193.7
UN	(S)	49.9**	2.067*	–0.009	0.88**	12.41	10.2	117	171.3
UN	(G)	27.1	3.889**	–0.025*	0.85**	16.14	11.6	78	179.5
UN	(U)	33.6	2.454*	–0.011	0.85**	15.31	13.1	110	169.2
UN	(P)	28.9	1.287	–0.10	0.29*	14.06	22.8	67	72.1

* 5% l.o.s.

** 1% l.o.s.