GUJARAT AGRICULTURAL UNIVERSITY RESEARCH JOURNAL

LUME : 16 : NUMBER : 1 JULY, 1990

GAU RES. J. 16 (1)

Gujarat Agricultural University Research Journal

July, 1990
Vol. 16, No. 1

⁂

Editorial Office
Publication Unit,
Gujarat Agricultural
University,
Shahibag, Dafnala,
Ahmedabad-380 004.
(Gujarat State)
INDIA.

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AU Res. J. 1990. 16 (1) : 1–5

Effect of Seed Rates and Cutting Stages on Forage Yield of Maize Varieties

J. R. Patel, P. C. Patel and M. R. Saiyad

A.I.C.R.P on Forage Crops, GAU, Anand Campus, Anand-388 110

ABSTRACT

A field trial was conducted to study the effect of 3 seed rates (40, 50 and 60 kg/ha) and 3 cut- ng stages (Tasseling, Silking and Milk) on forage yield of two composite varieties of maize viz., Vijay nd Moti during *kharif* 1978 and 1979 at the Gujarat Agricultural University, Anand (Gujarat). The sults indicated that Vijay Composite recorded higher green forage, dry matter and crude protein elds. A seed rate of 50 kg/ha in Vijay Composite and 60 kg/ha in Moti Composite resulted in gher fodder and crude protein yields. A seed rate of 60 kg/ha gave higher net increamental cost nefit ratio than that of 50 kg seed rate/ha. Harvesting of maize varieties at milk stage for fodder urpose was found to be ideal for higher dry matter and crude protein yields.

(Received on 19th Aug. 1988)

INTRODUCTION

Maize (*Zea mays* L.) is an important ereal fodder crop on account of being cculent, sweet and palatable; and also free om toxicants. Different varieties need speci- c agronomic and cultural practices to know eir best potential in term of yield and uality. Information on stage of cuttings ong with seed rates is very meagre of the arieties tested in the present study. Hence, e present investigation was taken up.

MATERIALS AND METHODS

A field experiment was carried out at orage Research Farm, Gujarat Agricultural niversity, Anand (Gujarat) during *kharif* asons of 1978-79 and 1979-80 in a split-plot design. The treatment combinations of two composite maize varieties (Vijay and Moti) and three seed rates (40, 50 and 60 kg/ha) were assigned to the main plot. while three harvesting stages (Tassel, Silk and Milk) were alloted to sub plot. The gross and net plot areas were 12 m^2 and 6 m^2 respectively. The experimental soil is a deep well drained sandy olay loam having low amonut of available N (212.0 kg/ha), fairly rich in available phosphorus (62.0 kg P_2O_5/ha) rich in available potash (300.0 kg K_2O/ha.) A uniform basal dose of 50 kg N + 25 kg P_2O_5 + 25 kg K_2O per hectare was applied in furrow at the time of sowing and 50 kg N per hectare was top dressed after one month of sowing. The dry matter was estimated by drying the cut plant samples in oven at 70 to

80°C to a constant weight. Nitrogen content was estimated by modified Kjeldahl's method. Subsequently the protein content of dry matter was computed for each treatment by multiplying its nitrogen percentage with conversion factor 6.25. Crude protein per hectare was worked out by employing the following formula.

$$\text{Protein yield (q/ha)} = \frac{\text{Protein content in dry matte (per cent)} \times \text{Dry matter yield (q/ha)}}{100}$$

Recommended cultivation practices were followed for raising the crop.

RESULTS AND DISCUSSION

Varieties

The green forage yield of the two varieties did not differ significantly. However, Vijay Composite gave significantly higher dry matter yield than Moti Composite during 1979 and on pooled basis (Table 1). Vijay Composite also produced significantly higher crude protein yield than Moti Composite during 1979.It was also better on pooled basis. The yield was poor during 1978 as compared to 1979 due to high rainfall (576.9 mm in Aug. in 22 rainy days) was received after sowing of maize crop (27-7-88) and hence initial growth of crop was affected.

Seed rate

A seed rate of 60 kg/ha gave significantly higher green forage yield than 40 kg/ha during 1978 (Table 1). The pooled results

TABLE 1

Effect of seed rates and cutting stages on forage yields of maize varieties.

Treatments	*Yield (q/ha)*								
	Green forage			*Dry matter*			*Crude protein*		
	1978	*1979*	*Mean*	*1978*	*1979*	*Mean*	*1978*	*1979*	*Mean*
1.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*	*9.*	*10.*
Varieties (V)									
Vijay Comp.	242	324	283	46.0	73.0	59.5	3.88	5.75	4.82
Moti Comp.	226	306	266	42.4	66.3	54.4	3.93	4.55	4.23
S. Em. ±	12	7	7	2.2	1.9	1.5	0.19	0.14	0.48
C. D. at 5%	NS	NS	NS	NS	5.7	4.2	NS	0.42	NS

1.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*	*9.*	*10.*
Seed rate (R) (kg/ha)									
40	202	303	253	38.5	64.3	51.4	3.37	4.44	3.91
50	230	323	277	42.0	73.6	57.8	4.01	5.55	4.78
60	270	320	295	52.0	71.2	61.6	4.19	5.27	4.73
S. Em. ±	15	9	5	2.7	2.3	1.2	0.24	0.17	0.09
C. D. at 5%	44	NS	15	8.2	6.9	3.3	NS	0.51	0.25
Cutting stage (S)									
Tassel	300	321	312	46.6	50.8	48.7	4.58	4.18	4.38
Silk	210	330	270	39.0	70.0	54.5	3.39	4.72	4.06
Milk	192	291	241	47.0	88.1	67.6	3.65	7.39	5.03
S. Em. ±	8	6	25	1.5	1.7	9.5	0.13	0.12	0.79
C. D. at 5%	44	19	NS	4.4	4.9	NS	0.38	0.35	NS

also revealed that 60 kg seed rate/ha was significantly superior (295 q/ha) than other seed rates. Similarly, a seed rate of 60 kg/ha gave significantly higher dry matter yield than other seed rates during 1978 as well as on pooled basis. The highest production is the result of higher plant stand. Nehra *et al.* (1981) reported that the green forage and dry matter yields of maize were increased at 60 and 80 kg seed rate/ha over 40 kg seed rate/ha. A seed rate of 50 kg/ha was at par with 60 kg/ha for crude protein yield but it produced significantly higher yield than 40 kg seed rate/ha. A seed rate of 60 kg seed rate/ha gave higher net ICBR (1:1.15) as compared to 50 kg seed rate/ha (Table 3).

Cutting stage

The pooled green forage yield of maize did not differ significantly due to cutting stages. However, maize harvesting at tasseling stage gave significantly higher yield over silk and milk stages during 1978. Tassel stage was also found significantly superior than milk stage but it was at par with silk stage during 1979. Milk stage produced significantly higher dry matter yield than tassel and silk stage during 1978 and 1979 (except it was at par with tasseling stage during 1978). On average basis, the harvesting of maize at milk stage gave 38.8 and 24.0 % higher dry matter yield than tassel and silk stage respectively. Milk stage produced significantly higher crude protein yield than tassel and milk stages during 1979. On average basis also, milk stage produced 14.8 and 23.9 % higher yield than tassel and silk stage respectively. Chauhan *et al.* (1979) also reported that DM, DDM, CP, DCP and TDN yields were highest in crops harvested 60 days after sowing (Milking stage). Suresh Kumar *et al.* (1979) suggested that harvesting of maize varieties between 50 and 60 days after sowing was found to be ideal for better fodder yield with higher crude protein and mineral contents. Desai and Washko (1982) reported that the dry matter and crude protein yields increased as the harvests were delayed from the boot and anthesis to milk and maturity stages. The corresponding dry matter yield at boot, anthesis, milk and mature stages were obtained 5.81, 6.93, 8.90 and 13.83 mt/ha, respectively. So these results suggested that maize crop should be harvested at milk stage to obtain maximum nutrients.

Variety x Seed Rate

Vijay composite coupled with 50 kg seed rate/ha produced significantly higher green forage (305 q/ha), dry matter (64.3 q/ha) and crude protein (5.34 q/ha) yields than other treatment combinations barring Vijay Composite coupled with 60 kg seed rate/ha (Table 2). This interaction had also recorded higher net ICBR of 1 : 2.82 (Table 3). Thus the present study suggested that maize variety Vijay Composite should be sown at the rate of 50 kg seed/ha and harvested at milk stage to obtain higher green forage, dry matter and nutrients as well as net realization.

TABLE 2

Effect of varieties x Seed rates on green forage, dry matter and crude protein yield (q/ha) on pooled basis.

Varieties	*Green forage yield (q/ha) Seed rates (kg/ha)*			*Dry matter yield (q/ha) Seed rates (kg/ha)*			*Crude protein yield (q/ha) Seed rates (kg/ha)*		
	40	*50*	*60*	*40*	*50*	*60*	*40*	*50*	*60*
Vijay Comp.	243	305	301	50.5	64.3	63.6	3.81	5.34	5.02
Moti Comp.	262	248	289	52.3	51.2	59.6	4.00	4.23	4.44
S. Em.		7.27			1.63			0.13	
C. D. at 5%		20.53			4.61			0.36	

TABLE 3

Relative profitability of maize as influenced by seed rates.

Treatments	*Green forage yield (q/ha)*	*Total return Rs/ha*	*Additional return over 40 kg N/ha (Rs/ha)*	*Additional cost Rs/ha*	*Net ICBR*
1.	*2.*	*3.*	*4.*	*5.*	*6.*
Seed rates (R) kg/ha					
40	253	2530	—	130.00	—
50	277	2770	240	162.50	1 : 0.48
60	295	2950	420	195.00	1 : 1.15

1.	*2.*	*3.*	*4.*	*5.*	*6.*
Interaction (V x R) Sig.					
Vijay Comp. x 40 kg	243	2430	—	130.00	—
Vijay Comp. x 50 kg	305	3050	620	162.50	1 : 2.82
Vijay Comp. x 60 kg	301	3010	530	195.00	1 : 1.97
Moti Comp. x 40 kg	262	2620	—	130.00	—
Moti Comp. x 50 kg	248	2480	—	162.50	—
Moti Comp. x 60 kg	289	2890	270	195.00	1 : 0.38

Cost calculated on the basis of Rs. 10/- per Q of green forage and Rs. 3.25 per one kg seed of maize.

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GAU Res. J. 1990. 16 (1) : 6–10

Intercropping of Fodder Legumes in Sorghum

R. H. Patel, K. B. Desai, M. S. Desai and M. N. Patel

Main Sorghum Research Station, Gujarat Agricultural University, Athwa Farm, Surat 395 007

ABSTRACT

Field experiment conducted to ascertain the effect of intercrops on sorghum revealed that higher grain as well as stover yield of sorghum CSH-5 was obtained when sown as 2 rows of sorghu 2 rows of cowpea at 30 cm apart with application of 40 kg P_2O_5/ha. as basal dose. The compar economics indicated that sorghum intercropped with 2 rows of forage cowpea recorded the highest ret It was also observed that higher gross income could be obtained in all the intercropping systems as c pared to sole sorghum.

(Received on 19th Aug. 19

INTRODUCTION

High yielding varieties and hybrids released for general cultivation can respond to higher dose of Nitrogen and Phosphorus. However, farmers are not applying the recommended doses of these fertilizers and hence the production level in sorghum is affected in the state. For maintaining the yield data intercropping of fodder legume is the most beneficial as legume left soil richer in Nitrogen than pure sorghum after harvest. Waghmare (1980) reported residual effect of intercropping combinations having cowpea (Fodder) in rainfed conditions. There was a saving of Nitrogen due to fodder cowpea.

It is amply clear from the earlier studies that intercropping is feasible and economical in sorghum. Balasubramanian *et al.* (1982) observed that there were no significant differences between the treatments with regard to sorghum grain and stover yield and the comparative economics indicated that sorghum intercropped with 2 rows forage cowpea recorded the highest returns.

Nimbalkar and Dombale (1983) served that if certain crops are intercropp with sorghum, the combined yield obtain may be higher from both crops without ducing the yield of the main crop. Th further observed that sorghum intercropp with udid gave the highest monetary retur as compared to sorghum alone. Howeve Nimbalkar and Shinde (1983) obtained t highest grain yield of sorghum when grow alone. But tur grown as an intercrop increa ed the monetary returns as compared sorghum grown alone.

Intercropping of sorghum with legum and oilseed has become a profitable practic now a days. It is observed that the yiel recovery of many inter crops representin important pulse and oilseed has been increase (Singh 1979). Therefore an attempt was made to know the further agronomic aspects of intercropping sorghum with cowpea, sunhemp and wal.

MATERIALS AND METHODS

A field experiment was conducted with 4 treatments (T_1 = Sorghum alone CSH-5, T_2 = Sorghum CSH-5 + Cowpea, T_3 = Sorghum CSH-5 + Sunhemp and T_4 = Sorghum CSH-5 + *Wal*) during 1983-84 to 1986-87 in RBD with 4 replications at the Main Sorghum Research Station, Gujarat Agricultural University, Athwa Farm, Surat. The crop was sown in 2 rows of sorghum : 2 rows of legumes at 30 cm apart. The sowing of the experiment was carried out in July during all the years. The basal dose of 40 kg P_2O_5/ha was applied to sorghum and the forage crops were uprooted and burried at the time of flowering. The data on grain and fodder yield of sorghum were pooled and their economics were workedout.

RESULTS AND DISCUSSION

The data on grain and stover yield for individual RBD analysis are presented in Table-1. It is revealed that treatments were

TABLE 1

Variances for grain and fodder yield in intercropping of fodder legumes. (Individual year)

ANOVA *Grain yield/stover yield.*

Individual year

Source	*d. f.*	*M.S.S.*			
		1983-84	*1984-85*	*1985-86*	*1987-88*
Repli.	3	48976.6 4854.5	13299.5 58788.8	55596.8 238838.1	977.2 44396.7
Treat	3	13749.7 125535.3**	293304.0** 606128.3**	238212.4** 3131906.1**	356663.5** 1362892.2**
Error	9	27476.5 31983.2	8154.7 57479.2	23439.8 113906.2	10443.8 17581.3
Total	15	—	—		
S. Em. ±		82.88 89.42	45.15 119.87	76.55 168.75	51.09 66.30
C. D. 5%		NS 286.05	144.44 383.47	244.88 539.82	163.46 212.08
C. V. %		8.91 4.04	5.14 6.46	7.95 6.60	4.69 2.60

Pooled

Source	*d. f.*	*M.S.S.* *Grain yield*	 *Stover yield*
Repli./year	12	508057.18**	7114206.56**
Year	3	508057.18	7114206.56**
Treatment	3	710609.81**	4037609.06**
Year x Treat.	9	63773.28**	396284.25**
Pooled error	36	17378.69	55237.47
S. Em. ±		63.13	157.38
C. D. 5%		201.96	503.44
C. V. %		6.83	5.12

highly significant for grain yield except for the year 1983-84 whereas, treatments were highly significant for stover yield in all the years. Chi-square test showed that error variences were homogenous. Analysis of variences for pooled data revealed that years, treatments and years x treatments were highly significant for both grain and stover yield.

Economics of the grain and stover yield of sorghum based on four years data are presented in Table-2. The highest grain and stover yield was obtained in Sorghum + Cowpea treatment and the highest gross income also obtained when sorghum was intercropped with cowpea.

Singh (1979) has summarized the results of the experiment that cowpea not only proved good intercrop with sorghum for increasing the yield of sorghum but also improved the soil fertility and also improved the yielding potentiality of sequence crop. Further the effect of intercropping of cowpea in sorghum on production of ratoon sorghum were studies by Pawar and Thaval (1987) suggested that there was no difference in grain and fodder yield and grain to fodder ratio of sorghum ratoon due to residual effect of planting patterns, intercropping of cowpea in kharif sorghum and their interactions. In the present study further it was observed that the higher gross income could be obtained in all the intercropping systems than sorghum as a sole crop. Therefore it is advisable to intercrop sorghum with cowpea being more economical. These results are in agreement with the findings of Balasubramanian *et al.* (1982b), Nimbalkar and Dombale (1983). Thus intercropping of cowpea with sorghum proved beneficial in increasing yield of sorghum as well as good residual effect on next sequential crop.

Sr. No.	*Treatments*	*Yield/ha.*		*Addi. yield over control*		*Addi. income over control*		*Addi. cost over control*	*Gross income Rs./ha.*	*Addi. net return over control*	*Net C.B.R.*
		Grain	*Stover*	*Grain*	*Stover*	*Grain*	*Stover*				
1.	Sole Sorghum (CSH-5)	1724	4034	—	—	—	—	—	5465	--	—
2.	Sorghum CSH-5 +Cowpea	2223	5254	499	1220	998	610	175	7073	1608	1:8=18
3.	Sorghum CSH-5 + Sunhamp	1849	4548	125	514	250	257	200	5972	507	1:1=53
4.	Sorghum CSH-5 + Wal	1912	4523	188	489	376	245	150	6085	620	1:3=13

Cost of cowpea Rs. 7=00/kg.
Cost of sunhamp Rs. 2=00/kg.
Cost of Wal Rs. 6=00/kg.

Selling rates :
Grain Sorghum Rs. 2=00/kg.
Stover Rs. 0=50/kg.

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GAU Res. J. 1990. 16 (1) : 11–16

Influence of Nitrogen on Yield and Quality of Forage Sorghum Genotypes

J. R. Patel, P. C. Patel and B. .G. Patel

A.I.C.R.P. on Forage Crops, Gujarat Agricultural University, Anand Campus, Anand

ABSTRACT

A field experiment was conducted with four nitrogen levels (0, 40, 80 and 120 kg N/ha) and six forage sorghum genotypes (PC-6, SU-45, AS-14, AS-15, Imp. Ramkel and HC-136) at Forage Research Farm, Anand (Gujarat). Genotypes PC-6, AS-14, AS-15 and Imp. Ramkel were found promising to obtain higher green and dry matter yields with better quality. Increasing N application from 0 to 40, 80 and 120 kg N/ha increased green fodder production by 20.3, 21.6 and 24.9 and dry matter by 22.6, 22.7 and 26.3 per cent, respectively. Crude protein content and crude protein yield increased markedly with the successive increase in nitrogen levels. The netural detergent fibre (NDF) content, owever, reduced markedly with the successive increase levels. From the economic point of view, an pplication of 120 kg N/ha showed the maximum total returns. However, maximum net ICBR was btained from the application of 40 kg N/kg.

(Received on 31st Aug. 1988)

INTRODUCTION

Jowar (*Sorghum bicolor* (L.) Moench) s essentially a crop of the dry farming areas nd withstands heat and drought. This rop is grown for green as well as dry forage roduction over wider areas, particularly luring the *kharif* season. It is admirably dapted to varying soil and climatic condiions. Nitrogen fertilizer plays an important ole in increasing forage production of sorhum with better nutritive value. Keeping his point in view, six genotypes of forage orghum were evaluated under four levels of itrogen fertilizer application at Forage Reearch Farm. Gujarat Agricultural University, nand.

MATERIALS AND METHODS

A field experiment was conducted during *kharif* seasons of 1985. 1986 and 1987 on sandy loam soils, low in available nitrogen (158.8 kg/ha) and medium in available P_2O_5 (45 kg P_2O_5/ha) and K_2O (199 kg/ha) The soil pH was 8.8. There were six forage sorghum genotypes (PC-6, SU-45, AS-14, AS-15, Imp. Ramkel and HC-136) and four levels of N (0, 40, 80 and 120 kg/ha) forming twenty four treatment combinations. This trial was carried out with three replications using factorial randomised block design. The gross plot size was 5 x 3.6 m^2 and net 4 x 2.4 m^2. Half of the required N in the form of urea, entire quantity of P_2O_5 (single superphosphate) @ 30 kg/ha and carbofuran 3 G @ 20 kg/ha were applied in the furrows. The seeds were drilled in rows 30 cm apart on 22nd July, 1985; 18th July, 1986 and 27th July, 1987 using 30 kg seed/ha. The remaining half of the N was topdressed one month after sowing. Other cultural practices were followed per recommendations. The crop was harvested at 50 per cent flowering stage which occured between 67 to 91 days after sowing depending on genotypes.

The harvested green forage was weighed immediately and 500 g sample from each treatment were collected randomly for dry matter estimation. Green samples were cut into small pieces and first air dried and then over dried at 70:C. The dry matter weight was separately recorded for each treatment. The total N was estimated by conventional Kjeldhal's method.

RESULTS AND DISCUSSION

Green forage and dry matter yield

The results (Table 1) indicated that green forage yields of genotypes HC-136, Imp. Ramkel, AS-14 and AS-15 were not significant, however, dry fodder yields were higher from PC-6 followed by Imp. Ramkel, AS-15, HC-136 and AS-14. Variety SU-45 gave minimum green and dry fodder yields during all the three years. So far as green and dry fodder production per unit time is concerned, it was maximum in AS-14 (6.0 x 1.36 q/ha/day), followed by AS-15 (4.85 x 1.30 q/ha/day) and PC-6 (4.26 x 1.42 q/ha/day) due to less number of days taken by these genotypes for harvesting stage.

Increasing level of N application from 0 to 40, 80 and 120 kg/ha increased the green forage production by 20.3/21.6 and 24.9 per cent, respectively, on pooled basis. The corresponding increases in dry matter production were recorded to the level of 22.6, 22.7 and 26.3 per cent, respectively. The increased yields of green forage and dry matter with nitrogen application were due to increased vegetative growth of plants (Table-1). Cooper (1956) and Patel (1958) reported that green forage and dry matter yields of forage sorghum increased with nitrogen application probably due to increased vegetative growth of plants. The maximum net Incremental Cost Benefit Ratio (ICBR) of 1:1.91 was obtained with an application of 40 kg N/ha.

The interaction of genotype x nitrogen levels were found non-significant for green forage and dry matter yields on pooled basis. So it is recommended that the farmers of Middle Gujarat region are advised to use 40 kg N/ha to forage sorghum for obtaining higher forage yields and net realization.

Crude protein and natural detergent fibre content

The highest crude protein content (Table-2) was synthesized by the genotype HC-136 (6.17%) followed by AS-14 (6.11%) and Imp. Ramkel (6.10%). The highest crude protein content was synthesized by the highest level of N during all the individual years as well as on an average of three years (Table 2). The crude protein content of sorghum increased from 5.50 to 6.10 per cent to 6.28 and 6.36 at 0 to 40 to 80 and 120 kg N/ha. Increased crude protein content of sorghum by increasing N application was also observed by Desai and Deore (1980) and Hussein *et al.* (1980).

Genotypes AS-14 and Imp. Ramkel showed lowest NDF (69.0%) as compared

TABLE I

Green forage and dry matter yields of forage sorghum genotypes as influenced by nitrogen.

Treatments	*Green forage yield q/ha*				*Dry matter yield q/ha*				*Yield in q/ha/day Av. of three years*		*Average of three years*	
	1985	*1986*	*1987*	*Pooled*	*1985*	*1986*	*1987*	*Pooled*	*GF*	*DM*	*Plant height (cm)*	*No. of leaves plant*
Genotype (G)												
PC-6	348	324	323	332	109.3	105.9	117.5	110.9	4.26	1.42	221.2	10.9
SU-45	286	276	286	283	74.6	77.5	100.5	84.2	3.99	1.19	212.3	11.2
AS-14	398	333	477	402	83.8	75.3	115.0	91.4	6.00	1.36	226.3	11.1
AS-15	401	340	394	378	92.7	91.6	119.6	101.3	4.85	1.30	209.7	11.4
Imp. Ramkel	396	349	324	356	102.5	106.4	98.5	102.5	4.19	1.20	187.2	11.4
HC-136	443	328	379	383	98.2	88.6	99.8	95.5	4.45	1.11	203.5	12.3
S. Em ±	12	23	14	21	2.8	6.1	3.9	5.4				
C. D. at 5%	33	NS	40	66	7.8	17.4	11.1	NS				
Nitrogen (N) (kg/ha)												
0	327	257	331	303	80.2	71.6	96.7	82.8			194.2	10.9
40	377	342	381	367	91.8	94.9	117.6	101.5			206.5	11.0
80	392	355	366	371	100.1	99.5	105.3	101.6			216.3	11.7
120	419	346	377	381	102.0	97.4	114.4	104.6			223.1	11.8
S. Em. ±	9	19	12	8	2.2	5.0	3.2	3.1				
C. D. at 5	27	53	33	22	6.4	14.2	9.1	10.7				
Int. G. x N	NS	NS	NS	NS	NS	NS	Sig.	NS				

TABLE 2

Quality parameters of forage sorghum genotypes as influences by nitrogen.

Treatments	Crude Protein (%)				Crude Protein yield (q/ha)				Neutral Detergent Fibre Content (%)			
	1985	1986	1987	Mean	1985	1986	1987	Mean	1985	1986	1987	Mean
Genotypes												
PC-6	6.31	6.06	5.36	5.91	6.91	6.36	6.29	6.53	77.4	69.1	67.7	71.4
SU-45	6.87	6.32	4.91	6.03	5.20	4.89	4.99	5.03	72.3	69.5	69.5	70.4
AS-14	6.46	6.32	5.54	6.11	5.54	4.79	6.38	5.57	67.1	71.4	68.4	69.0
AS-15	7.07	6.09	4.94	6.03	6.53	5.59	5.90	6.01	73.0	72.3	63.3	69.5
Imp. Ramkel	7.13	5.51	5.67	6.10	7.35	5.90	5.63	6.29	72.7	71.3	62.9	69.7
HC-136	6.69	5.28	6.55	6.17	6.57	4.72	6.59	5.96	70.7	67.7	69.7	69.4
Nitrogen (kg/ha)												
0	5.79	5.67	5.05	5.50	4.75	4.06	4.88	4.56	72.9	70.8	66.8	70.2
40	7.04	5.70	5.55	6.10	6.37	5.37	6.48	6.07	72.9	69.9	66.6	69.8
80	7.00	6.15	5.69	6.28	6.93	6.02	5.98	6.31	72.5	68.7	66.6	69.3
120	7.19	6.20	5.70	6.36	7.35	6.06	6.51	6.64	70.5	71.4	67.8	69.9

to other genotypes on an average of three years while the highest NDF (71.4%) was obtained in PC-6. Gupta *et al.* (1983) also reported such type of variation in sorghum genotypes. The NDF content was reduced as the successive increase of nitrogen from 0 to 80 kg N/ha although the differences were marginal. Similar type of results were also obtained by Oberoi (1981) in oats.

Crude protein yield

Genotype PC-6 produced the highest crude-protein yield (6.53 q/ha) followed by Imp. Ramkel (6.29 q/ha) and AS-15 (6.01 q/ha). The variation in the yield of crude protein could be attributed to differential potentially of genotypes to synthesize protein and variation in the dry matter production. Increaseing trend of crude protein yield was observed with successive increments of N. The higher level of nitrogen (120 kg/ha) produced the highest crude protein yield (6.64 q/ha) an average of three years than other levels of nitrogen. Increasing level of N application from 0 to 40, 80 and 120 kg N/ha increased the crude protein yield by 33.1, 38.4 and 45.6 per cent, respectively, on an average of three years. The results are in accordance with the results obtained by Hegde and Relwani (1974).

TABLE 3

Economics of forage sorghum as influenced by nitrogen levels.

Treatment	*Pooled green forage yield (q/ha)*	*Total return Rs./ha*	*Additional return over control Rs./ha*	*Additional cost Rs./ha*	*Gross ICBR*	*Net ICBR*
Nitrogen levels						
0 kg N/ha	305	3050	—	—	—	—
40 kg N/ha	367	3670	620	212.80	1:2.91	1:1.91
80 kg N/ha	371	3710	660	425.60	1:1.55	1:0.55
120 kg N/ha	381	3810	760	638.40	1:1.19	1:0.19

Selling price of green forage of sorghum Rs. 10/q.
Cost of nitrogen @ Rs. 5.32 per kg of nitrogen from urea.

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GAU Res. J. 1990, 16 (1) : 17–22

Response of Summer Groundnut (*Arachis hypogea* L.) to Dates of Sowing, Planting Geometry and Levels of Phosphorus under South Gujarat Conditions

R. M. Desai, Z. G. Patel, H. C. Patel, A. D. Patel, H. C. Patel and H. B. Patel

Department of Agronomy, N. M. College of Agriculture, Navsari

ABSTRACT

An experiment was conducted at the College Farm, Gujarat Agricultural University, Navsari on groundnut (Var. GAUG-1) in summer seasons of 1982 to 1984 on clayey soil. Three dates of sowing (1st and 15th February and 2nd March) as main plots were tried with there levels of phosphorus (25, 50 and 75 kg P_2O_5/ha) and two spacings (30 and 45 cm between rows) as sub plot treatments in a split plot design. Significant reduction in pod yield was recorded by delay in sowing from 1st February to 2nd March. Highest fodder yield was obtained with sowing on 15th February. Effect of different levels of phosphorus and spacing was not significant indicating that 25 kg P_2O_5/ha is sufficient for summer groundnut on vertisol with 30 x 10 cm or 45 x 7.5 cm as planting geometry.

(*Received on 22nd Sept. 1988*)

INTRODUCTION

Practice of raising summer groundnut crop in command area of Ukai-Kakarapar irrigation project is a newly adoptation and hence adequate information is not available regarding agronomic practices. The groundnut crop being insensitive to photoperiod, the major weather parameter that influences the growth and yield, is the temperature. The influence of air temperature on the yield of groundnut was striking during pegging and pod development stages of the crop (Ono and Ozaki, 1974). Plant geometry is also an important factor influencing photosynthetic activity of the plant and ultimately the yield. Besides maintaining optimum plant population, changing the geometry of planting can influence moisture and nutrition extraction pattern from the soil (Raddy *et al.*, 1978). In contrast to most of the other crops, the groundnut crop can use soil phosphorus at lower test level (Scarsbrook and Cope, 1956). Martin (1964) in a world-wide review on fertilization to peanuts pointed out that in most areas pea-nuts depended on residual phosphorus applied to previous crop. Considering these views, the experiment was conducted to findout the adequate requirement of P, best period of sowing and spacing between two rows for South Gujarat conditions.

MATERIALS AND METHODS

The experiment was conducted at the College Farm, GAU, Navsari during the summer seasons of 1982 to 1984 on vertisols having pH 7.8, Ec 0.11 mmhos/cm, low in N, medium in available phosphorus (24 kg P_2O_5/ha) and rich in potash. Total eighteen treatment combinations involving three dates of sowing (1st and 15th Feb. and 2nd March) in main plots and combinations of two planting geometry i. e. (30 x 10 and 45 x 7.5 cm) and three levels of phosphorus (25, 50 and 75 kg P_2O_5/ha) in sub plots were employed under split plot design with four replications. The seed rate was 100 kg kernels/ha. The errect type groundnut variety GAUG-1 was employed. A common dose of N @ 25 kg/ha in the form of urea along with single superphosphate as per treatment was band placed before sowing and in same line the crop was sown as per spacing. No potash was applied. The irrigations were given just after sowing and then at about 10 days interval till maturity. The crop was harvested in the beginning of June every year. The yields of pod as well as dry fodder were recorded plotwise. The fodder was spoiled during 1983 due to premonsoon rain, hence not recorded.

RESULTS AND DISCUSSION

The mean yield data of pod as well as dry fodder as affected by different treatments are presented in Table-1.

Effect of dates of sowing

The data given in table-1 revealed that the pod yield was significantly affected by dates of sowing in all the years and also in data pooled. Significantly the highest pod yield was recorded with sowing on 1st Feb. followed by 15th Feb. and 2nd March. The reduction in pod yield was to the tune of 78, 70, 51 and 63 per cent during 1982, 1983, 1984 and in pooled, respectively, when crop sown on 2nd March. *Patel* (1982) also obtained the highest pod yield from sowing of 3rd Feb. Which was at par with 18th Feb. and significantly superior over 18th Jan. The same period was also found significantly superior over late sowing at Junagadh (Annual Progress Report 1979) and by Patel (1981). They have suggested that maximum pod yield from the crop sown during this period might be due to favourable climatic condition that existed during the crop growth period. Joshi *et al.* (1975) also recorded higher number of undeveloped pods per plant in late sown crop. Here reduction in yield might also be due to less period available for maturity as it was essential to harvest the crop before second week of June as it is a probable period for start of monsoon in this region.

From the two years data (table-1) it was observed that though the effect of dates of sowing was found to be significant in respect of fodder yield during both the years, was not significant on data pooled. During both the years and also in pooled analysis, the second data (15th Feb.) showed maximum fodder yield. Similar observations were also recorded by Patel (1982). He observed that the maximum fodder yield was obtained from the crop sown on 18th Feb. which was statistically at par with the sowing of 3rd Feb. The better development of growth parameters from sowing of first fortnight of February was observed by several scientists viz., Patel, 1982; and Joshi *et al.*, 1975 in respect of plant height and Patel (1981) and Patel (1982) in respect of number of branches per plant and Patel (1981) in respect of plant spread per plant.

The effect of temperature on growth of groundnut, studied by Joshi *et al.* (1975)

Effect of various treatments on pod and dry fodder yield of groundnut.

Treatment	*Pod yield kg/ha*				*Dry fodder yield kg/ha*		
	1982	*1983*	*1984*	*Pooled*	*1982*	*1984*	*Pooled*
(A) Dates of sowing							
D_1 (1st Feb.)	2927	3569	2347	2948	6782	5971	6377
D_2 (15th Feb.)	1582	3410	1513	2168	8363	6373	7368
D_3 (2nd March)	638	1076	1023	913	5293	6117	5705
S. Em. ±	134	101	155	132	393	56	754
C. D. 5%	463	348	536	391	1359	194	N.S.
(B) Levels of phosphorus							
P_1 (25 kg P_2O_5/ha)	1673	2680	1728	2027	6977	6258	6617
P_2 (50 kg P_2O_5/ha)	1657	2747	1558	1987	6466	6031	6248
P_3 (75 kg P_2O_5/ha)	1818	2629	1597	2015	7196	6173	6684
S. Em. ±	54	61	62	55	254	85	134
C. D. 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
(C) Spacing between two rows :							
S_1 (30 cm)	1666	2682	1584	1975	6784	6055	6419
S_2 (45 cm)	1772	2689	1672	2041	6975	6253	6614
S. Em. ±	44	50	51	28	207	69	109
C. D. 5%	N.S.	N.S.	N.S.	N.S.	N.S.	198	N.S.

indicated that cooler temperature resulted in delay in germination and slow growth of groundnut. In South Gujarat, the low temperature during 1st Feb. might have resulted in slow growth and had affected final fodder yield.

In late sowing the period available for growth is not sufficient and because of early onset of monsoon the harvesting is affected. Secondly high temperature of summer affected the peg formation and pod development might have affected the yield adversely (Joshi *et al.* 1975).

Effect of levels of phosphorus

The effect of different levels of phosphorus did not show significant effect on pod yield in all the years separately as well as in pooled data. The application of higher (75 kg P_2O_5/ha) level of phosphorus also failed to increase the pod yield. The results were in agreement with those of Aulakh *et al.* (1980), Shelke and Khuspe (1980) and Dubey and Shinde (1986). They observed that the application of various levels increased the yield significantly but the significant difference were only between control (no application) and lower levels ranging from 15 to 22.5 kg P_2O_5/ha. While other higher levels were at par. Similar results were also obtained at Navsari (A Research Report, 1985), in summer. Adams and Pearson (1970) opined that the phosphorus requirement of peanut crop is very low and therefore little or no response is expectable. Fox (1978) also observed much less requirement of external phosphorus. The contribution of surface soil for phosphorus fertility and association of micro-organisms in the rhizospheric environment might also be playing a definite role for the poor response of the crop (Patel and Kanzaria, 1985). Almost similar trend was recorded for dry fodder yield.

Effect of planting geometry

The effect of planting geometry did not reach to the level of significance in respect to pod yield in all the years and data pooled. Similar results were also reported by Reddy *et al.* (1978). On the other hand, Bhan and Misra (1971), and Gopalswami *et al.* (1979), recorded higher yield with narrow spacings whereas Joshi and Joshi (1964) recorded higher pod yield with wider inter row spacings and closer plant to plant spacings.

In present study, the formation of pods mainly on main shoot of non spreading variety GAUG-1 might be the probable reason for the poor effect of plant geometry on the pod yield. However, wider row spacing (45 cm) resulted in increase in fodder yield only during 1981. Non significant response of spacing to fodder yield was reported by Patel (1982). In contrast to this Bhan and Misra (1971), Reddy (1979) and Ramarao (1980) recorded higher fodder yield with narrow spacings. Interaction effects on pod yield.

Dates of sowing x levels of phosphorus

The interaction effect of date of sowing and level of phosphorus (table-2) was significant (pooled data). Within the date of sowing, phosphorus levels did not show significant effect except last date (2nd March). It is clear that the reduction in yield by delayed sowing was lessend with increase in P level. However, the yield obtained at higher level was so small that it seems to be uneconomical. Interaction effects on fodder yield :

TABLE 2

Interaction effect of dates of sowing and levels of phosphorus on pod yield (kg/ha) (Pooled data)

Date of sowing	*Levels of phosphorus kg P_2O_5/ha*		
	P_1 (25)	P_2 (50)	P_3 (75)
D_1 (1st Feb.)	3014	2975	2855
D_2 (15th Feb.)	2188	2192	2125
D_3 (2nd March)	879	795	1064
S. Em. ±	C. D. 5%	164	

Dates x planting geometry :

The interaction effect of date of sowing into planting geometry (table-3) was also found to be significant (pooled data). The highest yield (7636 kg/ha) was obtained from the sowing of 15th Feb. at 45 x 7.5 cm distance and was at par with the sowing of same date at 30 x 10 cm. Significantly the lowest yield (5410 kg/ha) was recorded with sowing on 2nd March at 30 x 10 cm planting geometry.

From the study it is concluded that farmers of South Gujarat should sow the groundnut variety GAUG-1 in first week of February along with 25 kg P_2O_5/ha, keeping the plant geometry 30 x 10 cm or 45 x 7.5 cm.

TABLE 3

Interaction effect of date of sowing and spacing on fodder yield (kg/ha). (Pooled data)

Date of sowing	*Spacings*	
	S_1 (30 *cm*)	S_2 (45 *cm*)
D_1 (1st Feb.)	6546	6207
D_2 (15th Feb.)	7301	7636
D_3 (2nd March)	5410	6000
S. Em. ± 189	C. D. 5%	533

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GAU Res. J. 1990. 16 (1) : 23–26

Gamma-Ray Induced Variability in Isabgul (*Plantago ovata* Forsk)

Diwaker R. Patel and K. C. Dalal

Medicinal and Aeromatic Plant's Scheme, Gujarat Agricultural University, Anand Campus, Anand-388 110

ABSTRACT

Dry seeds of Isabgul (*Plantago ovata* Forsk) variety Gujarat Isabgul-1 were irradiated in nitrogen atmosphere with gamma rays (10, 15, 20, 40, 80 and 100 kr) at BARC, Trombay. The plant progenies in M_2 generation were studied. Positive significant shifts in means were observed for the characters, length of spike and numbers of trillers per plant. Mutagenic treatments of gamma rays increased variability in M_2 generation in the progenies of most of the doses for most of the characters. The highest value of GCV accompanied by corresponding genetic parameters were observed at higher as well as lower doses of gamma rays for different characters.

(*Received on 17th Jan. 1989*)

INTRODUCTION

For our country, isabgul is one of the crops having high export potential. Because of it's high quality husk and bold seed, Indian Plantago (*P. ovata* Forsk) is preferred over European Plantago (*P. Psyllium* and *P.*) *indica*). In north Gujarat, where isabgul is grown, occurance of few showers during December to early April is not an uncommon phenomenon. Even light showers during late March to early April, the time when husk formation on the seed is in process and the crop is about to be harvested, shatter the seed completely and thus the farmer loses his crop totally or partially. In Isabgul, spikes do not mature synchronously. During years when unusual cool weather prevails during later part of March, relatively heavy dew formation (which is absorbed by hygroscopic husk) occurs and subsequently seed shattering from mature spikes has been observed. In case of the above shown nature's unusual phenomenon, a late maturing variety may solve some of the porblems. However, in the available germplasm, there does not exist much variability including that for maturity and synchronous flowering. It was thought to create genetic variability first through mutagens because it is a heritable one and that response to selection is also good.

MATERIAL AND METHODS

Dry seeds of Isabgul variety Gujarat Isabgul-1 were exposed to 10, 15, 20, 40, 80 and 100 Kr. of gamma rays in nitrogen atmosphere at BARC, Trombay, Bombay. The irradiated seed material was sown in experimental plots alongwith control to raise M_1 generation The M_2 generation was raised in compact family design with three replications taking irradiation dose as main plot and progenies as sub plot during Rabi 1978-79. Each progeny line consisted of 50 plants in a row of 4.3 meter length. Seven competitive plants from each progeny were selected and observations were recorded on yield per plant, days to maturity, length of spike, number of tillers per plant and percentage of noneffective spikes per plant. Mean values were statistically analyzed. Genetic co efficient of variation (GCV) and heritability (h^2) in broad sense (in percentage) were calculated using standard formulae.

RESULTS AND DISCUSSION

Significant shift in means were observed for days to maturity, length of spike, no. of tillers per plant at all the six doses of gamma rays; for yield per plant at 15, 40 and 100 kr. doses and for total number of spikes per plant at 10, 15, 40 and 80 kr. doses of gamma rays (Table-1). Positive and negative shifts in means observed could be attributed to either plus or minus mutations. The lack of significant shift in means observed for percentage of noneffective spikes per plant could be due to cancellation of the effect produced in positive and negative directions.

TABLE 1.

Estimates of mean values and genetic parameters of 6 characters in gamma irradiated M_2 progenies.

Irradiation dose	*Range*	*Mean*	*G.C.V.*	*P.C.V.*	h^2
(1) Yield per plant (gms)					
10 kr	2.7 — 9.3	5.59	24.5	24.8	97.0
15 kr	4.5 — 9.9	7.19*	18.2	19.2	89.6
20 kr	3.3 — 7.2	5.35	23.5	23.8	97.5
40 kr	5.1 — 8.5	6.74*	15.6	16.0	95.4
80 kr	2.1 — 9.9	5.90	32.2	32.4	98.8
100 kr	3.6 — 9.9	6.24*	24.3	24.7	97.1
Control	4.9 — 6.3	5.67	—	—	—
(2) Total No. of spikes per plant					
10 kr	34.0 — 90.2	59.7*	20.8	21.5	94.3
15 kr	53.5 — 118.8	75.8*	23.0	23.6	94.9
20 kr	34.4 — 79.6	55.2	18.9	19.6	93.6
40 kr	50.0 — 116.6	78.4*	24.0	24.4	96.9
80 kr	21.4 — 91.0	61.3*	26.6	26.4	97.3
100 kr	25.3 — 74.8	53.3	23.9	24.5	95.8
Control	11.6 — 61.9	54.7	—	—	—

1.	2.	3.	4.	5.	6.
(3) Days to maturity					
10 kr	103.0 — 106.7	104.7*	0.87	0.92	90.0
15 kr	111.9 — 115.4	113.7*	0.62	0.68	83.8
20 kr	98.2 — 100.4	99.7*	0.57	0.61	87.4
40 kr	95.1 — 98.3	96.8*	1.07	1.09	95.8
80 kr	94.0 — 96.6	95.2*	0.61	0.66	86.5
100 kr	104.0 — 107.4	105.9*	0.63	0.65	93.1
Control	106.0 — 111.0	109.6	--	—	—
(4) Length of spike (cms)					
10 kr	3.1 — 4.8	3.9*	5.0	6.9	52.3
15 kr	3.6 — 5.0	4.1*	3.4	5.2	42.8
20 kr	3.0 — 6.1	3.8*	6.4	9.2	48.7
40 kr	3.1 — 4.7	4.0*	3.9	6.5	34.9
80 kr	3.1 — 4.9	3.8*	4.3	7.3	34.8
100 kr	3.1 — 4.9	3.9*	9.3	10.1	85.1
Control	3.1 — 3.8	3.4	—	—	—
(5) No. of tillers per plant					
10 kr	2.7 — 5.6	4.1*	5.2	9.8	28.6
15 kr	3.3 — 6.3	4.3	7.8	10.9	51.3
20 kr	3.3 — 5.0	4.1*	3.8	7.1	27.9
40 kr	3.0 — 5.8	4.2*	7.1	10.4	46.5
80 kr	2.2 — 5.6	4.0*	7.7	10.4	49.0
100 kr	3.1 — 5.0	4.1	3.2	7.9	16.1
Control	3.0 — 3.6	3.2	—	—	—
(6) Percentage of non-effective spikes per plant					
10 kr	10.5 — 28.5	15.5	0.0	7.8	0.0
15 kr	10.2 — 26.2	18.4	4.7	6.6	50.5
20 kr	10.0 — 25.2	13.8	6.7	8.4	65.3
40 kr	10.6 — 24.2	15.5	11.2	11.9	97.6
80 kr	10.1 — 27.8	14.1	9.9	11.6	72.9
100 kr	10.1 — 22.3	14.4	0.0	7.7	0.0
Control	11.8 — 18.6	16.0	—	—	—

* Significant at 5% level.
GCV = Genetic coefficient of variation.
PCV = Phenotypic coefficient of variation.
h^2 = Heritability.

Increased range in irradiated populations as reported by Bhatia and Swaminathan (1962) was either due to increased recombination arising from crossing over near the centromere region or mutation in the polygenic system.

Mutagenic treatments of gamma rays induced genetic variability in all the doses in most of the characters studied. However, the treatments did not induce genetic variability at 10 and 100 kr for percengage of non-effective spikes per plant. The highest values of GCV accompanied by corresponding genetic parameters were observed both at higher and lower doses of gamma rays for different characters : at 15 kr for number of tillers per plant, at 40 kr for days to maturity and percentage of non-effective spikes per plant, at 80 kr for yield per plant and total no. of spikes per plant and at 100 kr. for length of spike. Hebetineka (1973) also reported such variable response of different quantitative characters to the mutagenic treatments of gamma rays in barley. He concluded that the frequency of mutations at different loci was variable. Therefore, a mutagenic treatment effective for causing variability for one quantitative character might not be as effective for another. The difference would be due to the no. of loci governing a quantitative character.

The characters, yield per plant, total no. of spikes per plant and days to maturity exhibited very high heritability indicating that these characters are under additive genetic control and selection for these traits would be highly effective. The characters with low heritability indicated that these characters are highly influenced by environmental fluctuations and selection for their improvement would not be effective.

ACKNOWLEDGEMENT

The authors are grateful to the Director, BARC, Trombay, Bombay for providing radiation facilities and Director of Campus, Gujarat Agricultural University, Anand Campus, Anand for providing facilities for conducting field experiment. The first author acknowledges the financial assistance provided by Isabgul Manufacturers' and Exporters' Association, Siddhpur for pursuing his M. Sc. (Agri.) studies.

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GAU Res. J. 1990. 16 (1) : 27–32

Cost of Production of Milk in the Urban Area with Special Reference to Surat City of Gujarat State

Darsi V. S. Rao & G. D. Parmar

Department of Agril. Economics, N. M. College of Agriculture, Gujarat Agricultural University,
Navsari Campus, Navsari

ABSTRACT

The expenditure on feed is the most important item of cost in dairy farming. The urban milk producers of Surat district incurred more expenditure on concentrate feeding as compared to rural milk producers, who spend more on dry fodder. The average total cost of maintenance of an animal per year accounted to Rs. 5866.98 and it was higher on large size farm group. The per litre cost of milk production was Rs. 2.82. The per litre cost showed positive trend with dairy farm size i. e. as the dairy farm size increases the per litre cost also increases.

(Received on 16th Sept. 1986)

INTRODUCTION

The change in the structure of traditional dairy sector to organised dairy activity, the studies on cost of production of dairy products especially of liquid milk have assumed greater importance in the country. Milk production business become part and parcel of agricultural business and is considered as an important economic activity. A large number of individuals especially in the urban demand centres started it as an economic occupation or major income generating source. The income from any business is influenced by the cost structure and price of the commodity that is produced. Milk production activity is not different from this.

MATERIALS AND METHODS

The present study on cost of maintenance of an animal was undertaken during the year 1980 in Surat City of Gujarat State. The main objectives of the study are (i) to study the cost maintenance of an animal per year in different dairy farm size groups, (ii) to study the cost of production of milk per letre in different dairy farm size groups. The data were collected from 60 milk producers of Surat milk producer's co-operative union of Surat city. The producers were grouped into three groups based on the number of animals with the producer viz., Group-I consists of milk producers having less than 30 animals (small dairy farm size group), Group-II consists of producers having 30 to 60 animals (medium dairy farm size group) and Group-III consists of producers having more than 60 animals (large dairy farm size group). Nearly 40 per cent of milk producers of Surat milk producers co-operative union were covered in the study. The costs were estimated on the basis of cost concepts i.e. Cost-A_1, Cost-A_2, Cost-B and Cost-C.

RESULTS AND DISCUSSION

Cost of maintenance of animal per year

The different types of costs are worked out per animal per year and presented item-wise in Table-1.

The data in the table show that the expenditure on feed (green fodder, dry fodder and concentrates) increases with size of the dairy farm. The average maintenance cost on feeds was Rs. 4,223.64 per annum (71.99 per cent in gross cost). Among the three groups of feeds, concentrates occupied a major share in the expenditure followed by dry fodder and green fodder i.e. on an average Rs. 2,174.04 (37.06 per cent), Rs. 1,321.26 (22.52 per cent) and Rs. 728.34 (12.41 per cent) respectively. The expenditure on feeds was higher (Rs. 4,494.48) on large size farm group and less (Rs. 4,128.48) on small size farm group. The depreciation charges were higher in large size farm group (Rs. 428.22; 7.05 per cent) and less in medium size farm group (Rs. 402.60; 6.96 per cent). The depreciation on animals was higher (Rs. 376.98; 6.43 per cent) followed by sheds (Rs. 21.96; 0.37 per cent) and then on equipment Rs. 14.64 (0.25 per cent).

TABLE 1

Cost of maintenance of animal per year (1980).

(Amount in Rs.)

Sr. No.	*Components of cost*	*Small size farms*	*Medium size farms*	*Large size farms*	*Overall the farms*
1.	*2.*	*3.*	*4.*	*5.*	*6.*
1.	Green Fodder	834.48 (14.22)	647.82 (11.20)	724.68 (11.94)	728.34 (12.41)
2.	Dry fodder	1357.86 (23.14)	1284.66 (22.22)	1354.20 (22.30)	1321.26 (22.52)
3.	Concentrates	1936.14 (33.00)	2250.90 (38.92)	2415.60 (39.79)	2174.04 (37.06)
	Sub-Total :	4128.48 (70.36)	4183.38 (72.34)	4494.48 (74.02)	4223.64 (71.99)
4.	Depreciation on animals	376.98 (6.43)	366.00 (6.33)	391.62 (6.45)	376.98 (6.43)

1.	2.	3.	4.	5.	6.
5.	Depreciation on sheds	21.96 (0.37)	21.96 (0.38)	25.62 (0.42)	21.96 (0.37)
6.	Depreciation on Equipment	21.96 (0.37)	14.64 (0.24)	10.98 (0.18)	14.64 (0.25)
	Sub-total :	420.90 (7.17)	402.60 (6.96)	428.22 (7.05)	413.58 (7.05)
7.	Paid labour	369.66 (6.30)	333.06 (5.76)	307.44 (5.06)	340.38 (5.80)
8.	Veterinay and medical charges	58.56 (1.00)	40.26 (0.70)	43.92 (0.73)	47.58 (0.81)
9.	Miscellaneous charges	29.28 (0.50)	43.92 (0.76)	29.28 (0.48)	36.60 (0.62)
10.	Interest on working capital	150.06 (2.55)	142.74 (2.47)	153.72 (2.53)	146.40 (2.50)
11.	**Cost-A_1**	5156.94 (87.89)	5145.96 (88.99)	5457.06 (89.87)	5208.18 (88.17)
12.	Interest on fixed capital	475.80 (8.11)	475.80 (8.23)	497.76 (8.20)	479.46 (8.17)
13.	**Cost-B**	5632.74 (96.03)	5621.76 (97.22)	5954.82 (98.07)	5687.64 (96.94)
14.	Value of family labour.	234.24 (3.99)	161.04 (2.78)	117.12 (1.93)	179.34 (3.06)
15.	**Cost-C**	5866.98 (100.00)	5782.80 (100.00)	6071.94 (100.00)	5866.98 (100.00)

Note : Figures in the parenthesis denote percentage to gross cost.

Source : Field Survey.

The paid labour charges were higher on small size farm group (Rs. 369.66; 6.30 per cent of gross cost) and lower on large size farm group (Rs. 307.44; 5.06 per cent). It was Rs. 333.06 (5.76 per cent) on medium size farm group. The per cent contribution of paid-labour in gross costs over all the groups accounted to 5.80 per cent. This showed that with increase in size of the group the paid labour charges were decreasing. The veterinary and medical charges were higher in small size farms (Rs. 58.56; one per cent) and lower in large size farms (Rs. 43.92; 0.73 per cent). These charges over all the size groups accounted to Rs. 47.58 (0.81 per cent) per animal per annum.

The miscellaneous expenditure by all the groups on an average came to Rs. 36.60 (0.62 per cent). These charges were higher in medium size group (Rs. 43.92; 0.76 per cent) and in small and large farm groups they accounted to Rs. 29.28 (0.50 per cent) and Rs. 29.28 (0.48 per cent) respectively. The interest charges reckoned on working capital were Rs. 146.40 (2.50 per cent) over all the groups per annum. It was higher on large size farms (Rs. 153.72; 2.53 per cent) followed by small size farms Rs. 150.06 (2.55 per cent) and then medium size farms Rs. 142.74 (2.47 per cent). The interest on fixed capital was the second largest item of cost, contributing in gross cost next only to feeds. Irrespective of the size group this item of cost accounted to Rs. 479.46 (8.17 per cent) per annum. It was higher on large size farm group (Rs. 497.76; 8.20 per cent).

The value of family labour reckoned at prevailing labour rates accounted to Rs. 179.34 (3.05 per cent) over all the farm size groups. The item of cost increases with decrease in the farm size group and vice versa.

The maintenance cost per animal per year depicted so far, indicated that feed formed the largest item of cost amounting to about 71 per cent in gross cost. Among different feeds, concentrates were the major item of expenditure accounting to 37 per cent followed by dry fodder and green fodder. It was interesting to note that in rural areas of Surat District Madalia and Charan (1976) noticed that the dry fodder contribution was the largest (i. e. 59.97 per cent) in the gross cost than concentrates (i. e. 8.77 per cent). However in the present study of Surat city concentrate feeding was prominent and then dry fodder follows. Hence it can be put forwarded that the urban milk producers of Surat District were incurring more expenditure on concentrate feed than the rural producers.

Cost-A, Cost-B and Cost-C Estimates

The data in the table show that on average Cost-A$_1$ per animal per year was Rs. 5,208.18 for overall the size groups. It was higher on large size farm group (Rs. 5,457) and lower on medium size farm group (5,145.96) and it was Rs. 5,156.94 in small size farm group. Cost-B was directly estimated after Cost-A$_1$ because the dairy sheds were owned by the producers and no rented sheds were present, hence Cost-A$_2$ was not studied. Cost-B was Rs. 5,687.64 per annum per animal over all the size groups. It was higher in large size farm group (Rs. 5,954.82) and lower on medium size farm group (Rs. 5,621.76). Irrespective of the farm size group the averagè gross cost (Cost-C) per animal per annum accounted to Rs. 5.866.98. It was higher on large size farm group (Rs. 6,071.94) and lower on medium size farm group (Rs. 5,782.80). The Cost-C on small size farm group came to about Rs. 5,866.98. The higher total costs incurred by large size farm group was due to more expenditure on feeding and also due to slightly higher capital investment than the rest of the groups.

Per litre cost of production

The cost of production per litre of milk was obtained by dividing each item of cost with total milk production and depicted in Table-2. The expenditure of per litre cost of milk production on feeds was Rs. 1.94 in small size farm group, Rs. 1.99 in medium size farm group and Rs. 2.29 in large size farm group. The expenditure on feeds irrespective of size group accounted to Rs. 2.03. Next important item of cost per litre of milk was interest on fixed capital i. e. 23 paise over

TABLE 2

Cost of production per litre of milk.

(Amount in Rs.)

Sr. No.	*Components of Cost*	*Small size farms*	*Medium size farms*	*Large size farms*	*Overall the farms*
1.	Green Fodder	0.39 (14.18)	0.31 (11.23)	0.37 (11.97)	0.35 (12.41)
2.	Dry fodder	0.64 (23.27)	0.61 (22.10)	0.69 (22.33)	0.64 (22.70)
3.	Concentrates	0.91 (33.09)	1.07 (38.17)	1.23 (39.81)	1.04 (36.88)
	Sub-Total :	1.94 (70.54)	1.99 (72.10)	2.29 (74.11)	2.03 (71.99)
4.	Depreciation charges	0.20 (7.27)	0.19 (6.88)	0.22 (7.12)	0.20 (7.09)
5.	Paid labour	0.17 (6.10)	0.16 (5.81)	0.16 (5.18)	0.16 (5.67)
6.	Veterinary and medical charges	0.03 (1.09)	0.02 (0.72)	0.02 (0.65)	0.02 (0.71)
7.	Miscellaneous charges	0.01 (0.36)	0.02 (0.72)	0.01 (0.32)	0.02 (0.71)
8.	Interest on working capital	0.07 (2.55)	0.07 (2.54)	0.08 (2.59)	0.07 (2.48)
9.	**Cost-A_1**	2.42 (88.00)	2.45 (83.71)	2.78 (89.97)	2.50 (88.65)
10.	Interest on Fixed Capital	0.22 (8.00)	0.23 (8.33)	0.25 (8.09)	0.23 (8.16)
11.	**Cost-B**	2.64 (93.00)	2.68 (97.10)	3.03 (98.06)	2.73 (96.81)
12.	Value of family labour	0.11 (4.00)	0.08 (2.90)	0.06 (1.94)	0.09 (3.19)
13.	**Cost-C**	2.75 (100.00)	2.76 (100.00)	3.09 (100.00)	2.82 (100.00)

Note : Figures in parenthesis indicate percentage to gross cost.

Source : Field Survey.

all the size groups followed by depreciation charges 20 paise. Next of importance was paid labour accounting to 16 paise over all the size farm groups. Veterinary and medical services and miscellaneous charges accounted to 4 paise for all the size farm groups.

The Cost-A, Cost-B and Cost-C estimates were greater in large size farm group and with increase in size of the farm the per litre cost of production increased. Cost-A and Cost-B per litre accounted to Rs. 2.42 and Rs. 2.64 in small size farm group and in large size farm group, they were Rs. 2.78 and Rs. 3.03 respectively. The total cost (Cost-C) to produce one litre of milk was Rs. 2.75, Rs. 2.76 and Rs. 3.09 in small, medium and large size farm groups respectively.

To conclude that the expenditure on feed is the most important item of cost. The urban milk producers of Surat district incurred more expenditure on concentrate feeding as compared to rural milk producers, who spends more on dry fodder. The average total cost of maintenance of an animal per year accounted to Rs. 5866.98 and it was higher on large size farm group. The per litre cost of milk production was Rs. 2.82. The per litre cost showed positive trend with dairy farm size i. e. as the dairy farm size increases the per litre cost also increases.

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GAU Res. J. 1990. 16 (1) : 33–38

Interaction Effect of Active Lime, FYM and Moisture Regimes on the Yield and P-Zn Composition of Wheat CV GW-120

B. A. Golakiya, M. S. Patel and G. S. Sutaria

Department of Agricultural Chemistry and Soil Science, Gujarat Agricultural University,
Junagadh Campus, Junagadh

ABSTRACT

A pot experiment was conducted to study the interaction of moisture, FYM and active lime on yield attributes, yield, concentration and uptake of nutrients (P, Zn and Ca) by wheat CV GW - 120. The grain and straw yield were almost doubled and the nutrient uptake was raised considerably due to FYM application under M$_2$ and the adverse effect of the stress on the yield and nutrient uptake under this moisture condition was buffered. The earhead length was significantly reduced with increase in the moisture tension and active lime alongwith the considerable reduction in the concentration and uptake of P, Zn and Ca. However, FYM incorporation under AL X F or M X F X AL interaction mitigated the adverse effect of active lime and leveled off these differences. **(Key words : Interaction, moisture, FYM, active lime and wheat).**

(Received on 14th Aug. 1989)

INTRODUCTION

No any reaction in the soil takes place in utter isolation, rather it occurs in the midst of a number of interactions simultaneously. While interacting with the FYM and moisture regimes a so called adverse effect of active lime in the calcareous soils changes its direction and magnitude as evinced by the alteractions in the yield, yield attributes and chemical composition of wheat CV GW-120.

MATERIALS AND METHODS

A pot experiment was conducted on a vertisol (medium black calcareous soil) during winter 1986 with twelve treatment combinations consisted of two levels each of moisture —0.5 (M$_1$) and —1.0 bar (M$_2$), FYM 0 (F$_0$) and 2 per cent (F$_1$) and three levels active lime 0 (AL$_0$), 5 (AL$_1$) and 25 per cent (AL$_2$) of the total 30 per cent lime added in the soil. Some of the soil characteristics are : send 13.0%, silt 30.3%, clay 56.7%, pH 7.8, EC 0.18 ds m^{-1}, CaCo$_3$ 3.3%, CEC 53.0 m. e. 100 g^{-1}, exhangeable Ca 44.5 and Mg 6.4 m. e. 100 g^{-1}, organic carbon 0.84%, Olsen's P 5.73 ppm P_2O_5, available K 172.5 ppm K_2O and DTPA extractable Zn 0.62, Fe 6.53, Cu 3.22 and Mn 11.56 ppm. The polythylene lined earthen pots (12 liter volume) were filled with 12 kg of the treated soil. Wheat CV GW-120 was sown, which was thinned to nine plants per pot a week after germination. The plant samples were digested in a di-acid mixture as described by Jackson and Ulrich (1969). The acid extract was used for analysis of different nutrients viz., P, Ca and Zn. Phosphorus in the acid extract was determined by vanadomolybdophosphoric yellow colour method, Ca by Versanate method (Jackson, 1958) and Zn by atomic absorption spectrophotometry (Shimadzu Model AA-640-13).

RESULTS AND DISCUSSION

Yield attributes and yield

Moisture and FYM exerted significant interaction on the yield attributes and yield (Table 1). Incorporation of FYM at both the moisture levels produced positive effect on yield attributes especially the earhead length, the test weight and the yield, however, its magnitude was comparatively low under high moisture tension. Application of FYM under M_1 almost doubled the grain and straw yield to that recorded under M_2F_0. Application of FYM to the crop under M_2 mitigated the adverse effect of moisture stress on the straw and raised the grain yield which was almost equal to that realized under M_1F_0. The credit goes to the phenomenal increase (8%) in the water holding capacity of the soil on account of FYM application as also reported by some earlier workers (Vaughan and Malcolm, 1985).

Interaction effect of moisture and active lime was significant only in case of earhead length, which decreased with increasing moisture tension and active lime. This is attributed to diminished water holding capacity (14%) of soil with increasing active lime.

TABLE 1

Interaction effect of M x F, M x AL and M x F x AL on yield attributes and yield of wheat CV GW-120.

Treatments combinations	*Plant (cm)*	*Effective tillers*	*Earhead length (cm)*	*Test weight (g)*	*Grain* ($g\ pot^{-1}$)	*Straw* ($g\ pot^{-1}$)
1.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*
M_1F_0	42.71	15.88	5.66	40.71	12.44	25.73
M_1F_1	56.48	20.15	7.73	43.29	16.59	45.17
M_2F_0	40.52	12.29	4.33	36.48	9.60	20.90
M_2F_1	44.10	18.19	5.26	37.68	13.66	23.89
CD (0.05)	5.78	3.03	1.06	1.57	4.10	8.67
M_1AL_0	54.48	18.52	6.95	42.42	18.58	36.98
M_1AL_1	47.53	17.98	6.78	41.69	14.41	35.20
M_1AL_2	46.77	17.53	6.36	41.90	13.56	34.18

1.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*
M_2AL_0	43.01	15.39	4.97	37.50	12.64	23.86
M_2AL_1	42.16	14.91	4.78	37.11	11.27	21.68
M_2AL_2	41.75	15.42	4.65	36.63	10.99	21.64
CD (0.05)	NS	NS	1.07	NS	NS	NS
F_0AL_0	42.43	14.17	5.28	39.31	12.52	25.11
F_0AL_1	41.52	13.61	5.06	38.25	10.65	22.42
F_0AL_2	40.89	14.47	4.65	38.23	9.90	22.41
F_1AL_0	55.06	19.73	6.65	40.60	15.70	35.73
F_1AL_1	48.18	19.28	6.50	40.55	15.03	34.45
F_1AL_2	47.63	18.48	6.35	40.31	14.65	33.41
CD (0.05)	NS	NS	1.07	NS	4.38	8.62
$M_1F_0AL_0$	49.79	16.63	6.07	41.43	14.01	28.28
$M_1F_0AL_1$	47.64	15.81	5.83	39.97	12.25	24.86
$M_1F_0AL_2$	46.00	15.19	5.10	40.75	11.05	24.07
$M_1F_1AL_0$	57.13	20.41	7.84	43.41	17.15	45.69
$M_1F_1\ AL_1$	56.00	20.16	7.74	43.41	16.57	45.54
$M_1\ F_1AL_2$	55.00	19.98	7.62	43.05	16.07	44.29
$M_2F_0AL_0$	44.83	11.72	4.49	37.20	11.04	21.45
$M_2F_0AL_1$	43.63	11.41	4.30	36.59	9.01	19.98
$M_2F_0AL_2$	43.54	13.75	4.21	35.70	8.73	20.76
$M_2F_1AL_0$	47.88	19.06	5.45	37.80	14.24	25.76
$M_2F_1AL_1$	48.21	18.41	5.26	37.68	13.50	23.37
$M_2F_1AL_2$	47.25	37.04	5.08	37.57	13.25	22.53
CD (0.05)	5.18	NS	2.20	NS	6.03	11.16

Interaction between FYM and active lime was significant in case of the earhead length and grain and straw yield. At a given level of FYM, increase in the active lime affected the earhead length and yield adversely. However, FYM application buffered the adverse effect of active lime and leveled off the differences among different active lime treatment under F_1. One can expect the ameliorative role of FYM here, in terms of soil physical, chemical and biological conditions (Chen and Avnimelech, 1986).

All the three soil factors interacted significantly over plant height, earhead length, grain and straw yield, which registered the highest values under $M_1\ F_1AL_0$ combination and the lowest under $M_2F_0AL_2$ except in case of straw yield which was lowest under $M_2F_0AL_1$ meaning that higher moisture tension and higher level of active lime were additive in adverse effect in absence of FYM. The difference between the grain and straw yield under $M_1F_0AL_0$ and $M_2F_0AL_2$ were levelled off by FYM application ($M_2F_1AL_2$).

Concentration and uptake of phosphorus, zinc and calcium

The concentration and uptake of P, Zn and Ca were affected significantly by moisture X FYM interaction (Table 2, 3). Concentration effect on P and dilution effect on Zn and Ca in the grain and straw were intensified with the incorporation of FYM. The uptake of all three nutrients was affected positively by FYM under both moisture levels. Contrary to this in case of moisture × active lime interaction, the concentration and uptake of P, Zn and Ca in the grain and straw were significantly but adversely affected by incorporation of active lime along with each level of moisture. However, this adverse effect of active lime on the concentration and uptake of P, Zn and Ca in the grain and straw was mitigated when FYM was incorporated under F x AL and M x F x AL interactions. (Table 2, 3).

TABLE 2

Interaction effect of M x F, M x AL, F x AL and M x F x AL on the concentration and uptake of phosphorus by wheat CV GW-120.

Treatment combinations	*P concentration (mg g^{-1})*		*P uptake (mg pot^{-1})*	
	Grain	*Straw*	*Grain*	*Straw*
1.	*2.*	*3.*	*4.*	*5.*
M_1F_0	1.86	0.71	48.02	18.26
M_1F_1	5.03	0.78	83.44	35.23
M_2F_0	4.71	0.94	45.21	19.64
M_2F_1	5.32	1.15	72.94	27.47
CD (0.05)	0.76	0.14	11.46	10.09
M_1AL_0	4.59	0.87	71.51	32.17
M_1AL_1	4.62	0.74	66.57	26.05
M_1AL_2	4.13	0.62	56.00	21.19
M_2AL_0	5.20	1.20	65.73	28.63
M_2AL_1	5.08	0.99	57.25	21.46
M_2AL_2	4.77	0.95	52.42	20.56
CD (0.05)	0.87	0.21	11.79	10.74
F_0AL_0	4.35	0.95	54.66	23.85
F_0AL_1	4.31	0.79	45.90	17.71
F_0AL_2	4.19	0.72	41.48	16.13
F_1AL_0	5.44	1.11	85.41	39.66

1.	2.	3.	4.	5.
F_1AL_1	5.39	0.94	81.01	32.38
F_1AL_2	4.71	0.85	69.00	28.40
CD (0.05)	0.87	0.21	11.79	10.74
$M_1F_0AL_0$	4.00	0.83	56.04	23.47
$M_1F_0AL_1$	3.94	0.76	48.26	17.40
$M_1F_0AL_2$	3.63	0.59	40.14	14.20
$M_1F_1AL_0$	5.18	0.91	88.82	41.57
$M_1F_1AL_1$	5.29	0.78	87.65	35.52
$M_1F_1AL_2$	4.63	0.66	75.00	29.23
$M_2F_1AL_0$	4.70	1.07	51.89	23.48
$M_2F_0AL_1$	4.69	0.88	42.39	17.58
$M_2F_0AL_2$	4.76	0.86	41.58	17.85
$M_2F_1AL_0$	5.69	1.32	81.02	34.00
$M_2F_1AL_1$	5.48	1.10	73.98	25.70
$M_2F_1AL_2$	4.79	1.04	63.47	23.43
CD (0.05)	1.10	NS	32.53	NS

TABLE 3

Interaction effect of M x P, M x AL, F x AL and M x F x AL on concentration and uptake of zinc by wheat CV GW-120.

Treatment combinations	*Zn concentration ($g\,g^{-1}$)*		*Zn uptake ($g\,pot^{-1}$)*		*Ca concentration ($mg\,g^{-1}$)*		*Ca uptake ($mg\,pot^{-1}$)*	
	Grain	*Straw*	*Grain*	*Straw*	*Grain*	*Straw*	*Grain*	*Straw*
1.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*	*9.*
M_1F_0	80.68	59.05	1003	1519	1.17	3.28	14.55	84.39
M_1F_1	66.97	69.11	1111	3121	1.16	3.10	19.24	140.03
M_2F_0	66.13	54.61	634	1141	1.02	3.35	9.79	70.01
M_2F_1	60.96	49.32	832	1178	0.93	3.11	12.70	74.30
CD (0.05)	0.33	0.20	24	25	0.03	0.03	0.56	1.43
M_1AL_0	73.68	75.30	1147	2784	1.27	3.11	19.78	115.00
M_1AL_1	74.33	62.71	1071	2207	1.06	3.23	15.27	113.69
M_1AL_2	73.47	54.24	996	1853	1.17	3.22	15.86	110.05

1.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*	*9.*
M_2AL_0	66.19	45.39	836	1083	1.00	3.40	12.64	81.12
M_2AL_1	60.53	55.18	682	1196	1.03	3.28	11.61	71.11
M_2AL_2	63.92	55.33	702	1197	0.89	3.00	9.78	64.92
CD (0.05)	0.40	0.24	29	31	0.04	0.04	0.69	1.75
F_0AL_0	73.37	55.60	918	1396	1.24	3.10	15.52	77.84
F_0AL_1	75.65	57.28	805	1284	1.11	3.53	11.82	79.74
F_0AL_2	71.20	57.62	704	1291	0.94	3.30	9.30	73.95
F_1AL_0	66.50	65.04	1044	2325	1.03	3.41	16.17	121.83
$F_1\ AL_1$	59.21	60.61	889	2088	0.98	2.98	14.73	102.66
F_1AL_2	66.18	51.95	969	1735	1.12	2.93	16.41	97.89
CD (0.05)	0.40	0.24	23	31	0.04	0.04	0.69	1.75
$M_1F_0AL_0$	81.43	62.82	1140	1776	1.39	2.91	19.47	82.29
$M_1\ F_0AL_1$	85.18	52.96	1043	1316	1.14	3.56	13.96	88.50
$M_1F_0AL_2$	75.43	61.38	834	1477	0.97	3.36	10.73	80.87
$M_1\ F_1AL_0$	65.93	87.77	1130	4010	1.14	3.31	19.55	151.21
$M_1F_1\ AL_1$	63.48	72.46	1051	3299	0.98	2.90	16.21	132.06
$M_1\ F_1AL_2$	71.50	47.11	1148	2046	1.37	3.09	22.00	136.85
$M_2F_0AL_0$	65.31	48.37	721	1061	1.09	3.30	12.03	72.43
$M_2F_0AL_1$	66.11	61.60	597	1236	1.07	3.51	9.67	70.12
$M_2F_0AL_2$	66.97	53.05	584	1101	0.90	3.24	7.85	67.26
$M_2F_1AL_0$	67.08	42.41	955	1092	0.92	3.51	13.10	90.42
$M_2F_1\ AL_1$	51.95	48.76	741	1139	0.94	3.06	13.36	71.51
$M_2F_1AL_2$	60.87	56.80	806	1279	0.98	2.77	12.98	62.41
CD (0.05)	0.57	0.35	41	43	0.05	0.05	0.97	2.47

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GAU Res. J. 1990, 16 (1) : 39–41

Short Communications

Effect of Seeding in Nursery and Age of Seedings at Transplating for Summer Rice Var. Mashuri

C. L. Patel, Z. G. Patel, I. G. Patel, R. B. Patel and A. G. Naik

Department of Agronomy, G.A.U., Navsari

The field experiment was conducted at the college farm, Gujarat Agricultural University, Navsari Campus, during summer season of 1981-82 and 1982-83 in split-plot design with four dates of seeding in nursery (1st Nov., 15th Nov., 30th Nov., and 15th Dec.) as main plot treatments and three ages of seedlings (45, 55 and 65 days old) as sub-plot treatments with four replications. The crop was fertilized with the recommended dose of fertilizer i.e. 100 kg N/ha and 50 kg P_2O_5/ha. Full quantity of phosphatic fertilizer and half quantity of nitrogenous fertilizer were applied as basal dose at the time of transplanting and the remaining quantity of nitrogen was top dressed in two equal splits, first at tillering stage and second at panicle initiation stage. The crop was transplanted at a distance of 25 cm x 15 cm with two seedlings per hill.

The data presented in Table 1 revealed that the highest grain yield was obtained when the crop was seeded on 30th November in the nursery during both the years, however during 1981-82, it remained statistically at par with 15th November and 15th December. The pooled data also showed the similar trend and it was higher to tune of 23.3, 19.4 and 23.1 per cent over 1st Novtmber, 15th November, 15th December, respectively. The maximum gross realisation (Rs. 9227.0/ha) was also secured from the same date (30th Nov.). This might be due to better establishments of seedlings in nursery.

The yield differences due to different age of seedlings were also found to be significant during both the years. Though the highest grain yield was obtained by transplanting 55 days old seedlings during both the years, it remained statistically at par with 45 days old sedlings during 1981-82. But in pooled data 55 days old seedlings gave outrightly the highest yield (4625 kg/ha). This might be due to better establishment of seedling and more vigour of seedling at the time of transplanting. The results are in contrast to those of Patel (1977) and Parmar (1977), who obtained higher yield from 45 days old seedlings for early and mid late rice varieties.

The pooled data on interaction effect given in Table 2 showed that significantly the highest grain yield (6174 kg/ha) was recorded under the treatment combination of seeding on 30th November and transplanting with 55 days old seedlings. The lowest yield (3347 kg/ha) however, was obtained from a

TABLE 1

Effect of different dates of seeding and age of seedlings at transplanting on grain yield of Mashuri rice grown in summer season.

Treatment	*Grain yield (kg/ha)*			*Gross realisation (Rs/ha)*
	1981-82	1982-83	*Mean*	
Date of seeding				
1st Nov.	3146	4722	3934	7081
15th Nov.	3796	4470	4133	7439
30th Nov.	4511	5742	5126	9227
15th Dec.	3778	4109	3943	7097
S. Em. ±	279	100	61	—
C. D. 5%	894	320	180	—
C. V. %	9.66	7.27	7.50	—
Age of seedlings at transplanting				
45 days	3813	4869	4341	7814
55 days	4269	4982	4625	8325
65 days	3341	4431	3886	6995
S. Em. ±	147	100	36	—
C. D. 5%	429	292	103	—
C. V. %	13.57	8.43	8.52	—
Interaction effect				
S. Em. ±	263	201	73	—
C. D. 5%	767	584	207	—
C. V. %	13.56	8.43	8.52	—

N. B. : Price of rough rice grain Rs. 1.80/kg.

TABLE 2

Interaction effect of date of seeding and age of seedlings at transplanting on grain yield of Mashuri in summer season. (Pooled data)

(Average grain yield (kg/ha)

Date of Seeding	*Age of seedlings*			
	45 days old	*55 days old*	*65 days old*	*Mean*
1st November	3733	3863	4206	3934
15th November	3893	4380	4125	4133
30th November	5340	6174	3866	5126
15th December	4397	4086	3347	3943
Mean	4311	4625	3886	

S. Em. ± 73
C. D. 5% 207

crop seeded on 15th December and transplanted with 65 days old seedlings. The yield showed increasing trend when seeded up to 30th November and transplanted with 45 and 55 days old seedlings, further delay in seeding up to 15th December caused decline in grain yield. Drastic reduction in yield was noted with each delay in sowing after 15th November and transplanting with 65 days old seedlings. Transplanted shock to young seedlings during cold days hinder the establishment of the crop for earlier seeded crop, old seedlings proved less vigourous and recorded poor yield.

(Received on 22nd July, 1985)

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GAU Res. J. 1990. 16 (1) : 42–46

Effect of Nitrogen, Phosphorus and Zinc Sulphate on Production Traits of Oat Forage

R. H. Patel and P. P. Vihol

Fodder Farm, Livestock Research Station,
Sardar Krushinagar

In India the scarcity of green fodder is one of the most important limiting factors for achieving "white revolution". Oat being a graminaceous fodder crop responds well to N fertilization (Sinha, 1968 and Saxena *et al.* 1971). The response to nitrogen is further increased if supplemented with phosphorus (Datta and Bains, 1961). Amongst micronutrients zinc aids in the formation of auxins and in the biosynthesis of indole acetic acid and also acts as metal activator of enzimes, thereby affecting the plant growth. In some cases, even no response of nitrogen or phosphate was seen unless the micronutrient deficiencies are corrected (Joshi and Joshi, 1957). However, the information about the requirement of nitrogen, phosphorus and zinc for oat forage crop in semi-arid region of North Gujarat, is scanty. In view of this an experiment was conducted to find out the optimum dose of nitrogen, phosphorus and zinc for maximising the green/dry yield of oat forage.

The experiment was conducted at Fodder Farm, Livestock Research Station, Gujarat Agricultural University, Sardar Krushinagar during *Rabi* season of 1982-83 on a loamy sandy soil with pH 7.7 The soil of the experimental plot had 0.293 per cent organic carbon, 14.17 kg available P_2O_5/ha, 376.3 kg available K_2O/ha and zinc content was 0.46 ppm. The treatment combinations consisted of four levels of N (N_{40}, N_{80}, N_{120} and N_{160}) kg N/ha, three levels of P (P_0, P_{30} and P_{60} kg P_2O_5/ha) and two levels of zinc sulphate (Zn_0 and Zn_{20} kg $ZnSO_4$/ha) and were tried in 4 x 3 x 2 factorial randomised block design with three replications. Half dose of nitrogen in the form of urea *and full dose of P_2O_5 in form of* DAP and zinc sulphate was applied before sowing and remaining half dose of nitrogen was applied after one month of sowing. Zinc sulphate was applied separately (not mixed with phosphate fertilizer). Kent variety of oat was sown in lines 25 cm apart on 12th November, 1982 at the seed rate of 80 kg/ha. The crop was harvested at about 50 per cent flowering stage. Data on the number of tillers per plant, height of the main shoot, leaf stem-ratio and yield of green and dry forage were recorded.

Effect of Nitrogen

Data presented in Table-1 showed that application of nitrogen in oat significantly enhanced the green as well as dry forage yield, with every successive increase in level of nitrogen. The highest green forage yield was recorded under the treatment of 160 kg N/ha which was 10.25, 32.01 and 61.71 per cent, higher than those of 120, 80 and 40 kg N/ha, respectively. Similarly, the highest yield (101.97 q/ha) of dry forage was recorded under the treatment 160 kg N/ha. This increase of yield was associated with increasing plant height and number of tillers. Probably, nitrogen application might have increased the protoplasmic contents, cell division and cell enlargement, thereby resulting into enhanced growth rate at vegetative phase of crop plants. Similar argument was also put forward by Gill *et al.* (1976) and Reddy and Tomar (1985).

It was observed that the leaf-stem ratio showed increasing trend with the increased rates of nitrogen. Nitrogen at 160 kg/ha and 40 kg N/ha. Hovewer, it was at par with 120 kg N/ha.

Effect of Phosphorus

Increase in levels of phosphate successively increased the green and dry forage yield. The highest forage yield was obtained with the application of 60 kg P_2O_5/ha. This increase in yield was also associated with increasing number of tillers/plant and plant height. Similar results were also reported by Gill *et al.* (1976). The application of phosphorus might have assisted the merismatic activities of plant growth either by increasing the uptake of nitrogen for vegetative growth or by extensive proliferation of roots, thereby, accelerating the absorption of nutrients for plant growth.

Effect of Zinc

Amongst micronutrients zinc has a vital role of plant growth has development. In many soils of India, micronutrients are becoming limiting factors in increasing crop production. However, the present results on most of the characters could not support it. Similarly, Mehta *et al.* (1973) and Ganguli and Relwani (1976) also could not observe any significant response to zinc. Probably zinc might be freely available in the soils of these experiments.

Interactions among treatments

The most of the interactions were non-significant in almost all parameters except NP in number of tillers and NPZ in plant height. The treatment combination N_{120} P_{60} produced significantly more number of tillers per plant than rest of combinations (Table 2). Similarly, the maximum plant height

TABLE 2

Number of tillers in oat forage affected by interaction between nitrogen and phosphorus levels.

Phosphorus kg/ha (P)	*Nitrogen (N) kg/ha*			
	40	*80*	*120*	*160*
P_0	1.34^{g}	1.54^{efg}	1.83^{d}	2.18^{c}
P_{30}	1.76^{de}	1.51^{fg}	2.59^{ab}	2.27^{c}
P_{60}	1.83^{d}	1.62^{def}	2.74^{a}	2.35^{bc}
S. Em. ±	0.08			
C. D. at 5%	0.24			

Means having same superscript did not differ significantly ($P \leq 0.05$) from one another.

TABLE 1

Effect of nitrogen, phosphorus and zinc sulphate on the ancillary characters of oat.

Treatment	*Green forage yield (q/ha)*	*Dry matter yield*	*Number of tillers/ plant*	*Height (cm/ plant)*	*Leaf-stem ratio*	*Economics Net profit (Rs./ha)*
Levels of Nitrogen						
N_{40}	403.20	70.00	1.64^a	100.1	0.554^a	1296^a
N_{80}	493.90	79.06	1.55^a	105.4	0.576^{ab}	1977^b
N_{120}	591.32	92.59	2.39^b	111.5	0.621^{bc}	2731^c
N_{160}	652.00	101.97	2.27^b	121.4	0.635^c	3118^d
S. Em. ±	12.46	3.16	0.05	1.4	0.020	107
C. D. at 5%	35.31	8.98	0.14	4.0	0.057	225
Levels of phosphorus						
P_0	463.12	77.83	1.72	99.8	0.592^d	1731^e
P_{30}	553.43	85.71	2.03^c	110.3	0.579^d	2461^f
P_{60}	588.77	94.17	2.13^c	118.7	0.619^d	2648^f
S. Em. ±	10.74	2.74	0.04	1.2	0.017	92
C. D. at 5%	30.51	7.77	0.12	3.5	N.S.	195
Levels of Zinc Sulphate						
Zn_0	535.94^a	86.17^a	1.95^d	108.8^a	0.600^a	2340^g
Zn_{20}	534.27^a	85.64^a	1.97^d	110.4^a	0.593^a	2220^g
S. Em. ±	8.80	2.24	0.03	1.0	0.014	75
C. D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Means having same superscript did not differ significantly ($P \leq 0.05$) from one another.

TABLE 3

Plant height in oat as influenced by interaction between nitrogen, phosphorus and zinc sulphate levels.

Zinc sulphate kg/ha (Zn)	*Phosphorus kg/ha(P)*	*Nitrogen (N) (kg/ha)*			
		40	*80*	*120*	*160*
Zn_0	P_0	82.4	96.7^{abc}	100.5^{abcd}	112.9^{fghij}
	P_{30}	93.7^{a}	106.2^{cdefg}	113.6^{fghijk}	121.1^{ijklm}
	P_{60}	115.0^{ghijk}	110.8^{efgh}	125.3^{lm}	127.5^{m}
Zn_{20}	P_0	94.8^{a}	96.3^{ab}	99.9^{abcd}	114.9^{fghijk}
	P_{30}	111.7^{efghi}	105.1^{bcdef}	107.4^{defgh}	123.3^{klm}
	P_{60}	102.7^{abcde}	117.1^{hijkl}	122.5^{jklm}	128.8^{m}
	S. Em. ±	3.5			
	C. D. at 5%	9.8			

Means having same superscript did not differ significantly ($P \leq 0.05$) from one another.

(128.8 cm) was observed in case of N_{160} $P_{60}Zn_{20}$ treatment combination, while minimum plant height (82.4 cm) was registered in case of $N_{40}P_0Zn_0$ treatment combination (Table 3).

The average net economic profit varied significantly among the nitrogen and phosphorus levels (Table-1). Maximum net profit of Rs. 3118 and Rs. 2648 was realised for N_{160} kg/ha and P_{60} kg/ha treatment respectively. However phosphorus levels P_{30} and P_{60} resulted more or less same net profit.

(Received on 15th Nov. 1987)

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GAU Res. J. 1990. 16 (1) : 47–48

Fluctuation of Green Leafhopper Population in Relation to Age of Rice Crop

H. V. Pandya, A. H. Shah and M. S. Purohit

Department of Entomology, N. M. College
of Agriculture, Gujarat Agricultural University,
Navsari Campus, Navsari-396 450.

A 2-year study was undertaken to know the relathionship between the green leafhopper, *Nephotettix nigropictus* (Stal.) population and age of the rise crop during *kharif* season of 1985 and 1986 at the National Agricultural Research Project Farm, GAU, Navsari. A Chinsura type light trap fitted witn a 200 W fluorescent lamp was used in the study. The trap was installed in the field growing GR 11, a susceptible rice cultivar. The catches of green leafhopper was determined at 25 days after seeding and consecutively at 15 days interval up to harvest. Simple correlation coefficient between age of the crop in days and number of green leafhopper caught was worked out by using the formula given by Panse and Sukhatme (1957).

The results revealed that there was a highly significant negative correlation between age of the crop and the population of green leafhopper as recorded on the Chinsura light trap (r = –0.97 and –0.95 during 1985 and 1986, respectively) (Table 1). The results indicated that with increase in age of the

TABLE 1

Fluctuation of green leafhopper (GLH) population in relation to age of rice crop during kharif 1985 and 1986.

Age (days)	*GLH trapped (No.)*	
	1985	*1986*
25	1150	1000
40	900	1200
55	750	800
70	500	600
85	250	300
100	150	400
115	100	50
130	50	40
'r'	–0.97**	–0.95**

** = Significant at 1% level.

crop, the population of green leafhopper decreased significantly. Dharma Reddy and Mishra (1983) also observed that the catches of green leafhopper decreased with increase in age of the rice crop in Eastern Uttar Pradesh. Similar study carried out by Kartohardjono (1984) for whitebacked planthopper indicated that the population of the pest peaked at 62 days after transplanting and then decreased. Gunathilagaraj and Chelliah (1984) also reported that the population of whitebacked planthopper was largest between 70 and 90 days after transplanting. *The present study indicated that green leaf*hopper thrived better on succulent crop rather than study crop. Hence, measures for controlling green leafhopper would work efficiently if taken at the younger age of the crop when initial build up of the pest is high.

ACKNOWLEDGEMENT

The authors are grateful to the Indian Council of Agricultural Research, New Delhi for providing financial assistance.

(*Received on 24th May, 1988*)

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GAU Res. J. 1990. 16 (1) : 49

Record of Powder Post Beetle, *Dinoderus minutus* Fabricius, as a Pest of Stored Rice in Gujarat State

D. A. Dodia, I. S. Patel, S. N. Patel and N. G. Patel

Main Rice Research Station, Gujarat Agricultural University, Nawagam (Gujarat)

Powder post beetle, *Dinoderus minutus* Fabr. (Coleoptera : Bostrichidae) is a pest of stored bamboo and bamboo objects, but also occurs in cereals. In India, occurrence of this pest damaging bamboo and its objects was reported by Beeson (1919), Hocking (1942), Gardner (1945), Mathur (1961) and Sandhu (1975). While De Charmoy (1915) observed its association with stored maize in Mauritius. It is incidence as a pest of stored rice in Gujarat was not reported earlier. During 1979-80, the pest was observed for the first time infesting stored rice damaging 41.91% in Gujarat State. Specimen of this pest was collected and sent to Commonwealth Institute of Entomology, London for its identity, which came as ***Dinoderus minutus*** Fabr.

Both the larvae and adult cause damage by feeding externally as well as internally in rice lowering its quality and quantity. The hatched larvae feed on the rice, bran and flour resulted from the feeding of full grown larvae and adults.

While studying its biology in laboratory, a Braconid parasite was also reared from the culture and was identified as *Apanteles ruficrus* Haliday (Braconidae : Hymenoptera).

ACKNOWLEDGEMENTS

The authors are highly thankful to the Director, Commonwealth Institute of Entomology, British Museum, London for identifying the insects and parasites.

(*Received on 24th June, 1988*)

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GAU Res. J. 1990 16 (1) : 50–52

Salinity, Sodicity and Boron Status of Soils and Well Waters of Inland Area of Amreli District (Gujarat)

G. L. Maliwal* and N. K. Timbadia

Department of Agril. Chemistry and Soil Science,
College of Agriculture, Junagadh

Boron though essential for plant growth but the amount required is very small. When it crosses a certain limit it becomes toxic and causes plant injury. Significant and positive correlations of water soluble boron with electrical conductivity (Paliwal and Anjaneyuly, 1967), pH (Mathur *et al.* 1964; Kanwar and Mehta, 1970 and Paliwal and Mehta, 1973) and SAR (Paliwal and Anjaneyulu, 1967) have been reported. Gandhi and Mehta (1958) have reported boron content in some arid zone soils of Saurashtra. The present study was taken up to study the boron status of well waters and irrigated soils and its relationship with some important properties of soils and waters under field conditions where saline water is being used.

Samples of ninety seven underground well waters and the same number of surface (0-15 cm) soils irrigated with them were collected from different villages of Amreli, Liliya and Lathi talukas of Amreli distrcit during February, 1984. The medium black soils of this area are of clay texture and calcareous in nature (6.6 to 15.0% $CaCo_3$). The area receives an annual precipitation ranging from 400 to 500 mm. The soils and water properties were determined as described by Richards (1954) Boron content in saturation extract of soil and in irrigation water was determined colorimetrically, using carmine Richards, (1954).

The data showed that the electrical conductivity of well waters ranged from 1 to 13 ds m^{-1} and boron concentration from 0.2 to 5.6 ppm with an average value of 2.1 ppm (Table 1). Boron was positively correlated with EC ($r=0.621$ **) and SAR ($r=0.340$ *) while the correlation with pH and SSP were not significant (Table 1). The higher positive correlation of boron with total salt concentration ($r^2 = 38.6\%$) as compared to pH and SAR showed that the boron was more associated with total salt concentration.

In another study, 97 surface soil samples irrigated with the above well waters were collected and analysed for pH, Ece, SAR, ESP and hot water soluble boron. The soils were found to be of saline-sodic and sodic in nature and their ECe ranged from 0.6 to 16.0 ds m^{-1} and ESP from 16.0 to 53.6. The total salt concentration was approximately 1.2 times as compared to well water (Table 2).

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* Present Address : Research Scientist and Head, National Agril. Research Project, Arnej 382 230.

TABLE 1

Properties of underground well waters and relationship of boron with other properties.

	ECe $ds\ m^{-1}$	*pH*	*SAR*	*SSP*	*Boron* (*ppm*)
Minimum	1.0	8.0	4.6	33.7	0.2
Maximum	13.0	9.1	55.5	97.1	5.6
Average	4.1	8.5	20.9	77.7	2.1
"r" value Boron V/S	0.621**	0.090	0.340*	−0.040	

** — Significant at $p = 0.01$.

* — Significant at $p = 0.05$.

The water soluble boron in saturation extract of saline-sodic soils varied from 0.25 to 5.6 ppm with an average of 1.64 ppm. In sodic soils, it ranged from 0.65 to 2.90 ppm with an average of 1.55 ppm (Table 2).

According to Bingham *et al.* (1985), the threshold concentration for the grain yield of wheat, barley and sorghum was 0.3, 3.4 and 7.4 mg β respectively.

TABLE 2

Properties of irrigated surface soil.

Soil	*No. of samples*	*ECe* $ds\ m^{-1}$	*pH* (1:2)	*SAR*	*ESP*	*Boron* (*ppm*)
Saline – Sodic	40	4.1 – 16.0 (7.1)	7.2 – 8.8 (7.6)	4.5 – 29.9 (16.0)	17.1 – 52.7 (32.8)	0.25 – 5.60 (1.64)
Sodic	57	0.6 – 3.9 (2.2)	7.2 – 9.0 (8.3)	10.6 – 40.4 (19.2)	16.0 – 53.6 (32.9)	0.65 – 2.90 (1.55)

Figures in parenthesis are the average values.

The relationship between water soluble B and other soil parameters (Table 3) showed that there was no significant correlation between B and ECe and B and SAR of sodic soils. In saline-sodic soils these parameters were significantly correlated with a low degree of determination ($r^2 = 0.16$). This shows that water soluble boron will increase with the enhanced degree of salinisation. Similar results were also reported by Paliwal and Anjaneyulu (1967) and Gajbhiye *et al.* (1980).

TABLE 3

Coefficient of correlation between soil properties and water soluble boron.

Soils	*Boron V/S*			
	ECe	*pH*	*SAR*	*ESP*
Saline—sodic	0.400*	0.290	0.420**	0.400
sodic	0.240	0.220	0.210	0.270*

** — Significant at $p = 0.01$

* — Significant at $p = 0.05$

There was no significant correlation between pH and boron content in both types of soil. They may be due to the several soil factors and their interactions influencing the pH and water solube boron simulteneously under field conditions.

There was positive correlation between exchangeable sodium percentage and boron in both the types of soils. However, the predictability was low. Agarwal (1964) also observed that in the range of 1 to 13 ESP, water soluble boron in soils also increased. Singh and Singh (1972) did not observe significant correlation between ESP and water soluble boron.

(*Received on 23rd Sept., 1986*)

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GAU Res. J. 1990. 16 (1) : 53–56

Evaluation of Phosphorimcter for Estimation Phosphorus Avilability of *Bhal* and Coastal Soils in Gujarat State

D. P. Motiramani, J. C. Patel, J. D. Giri
S. Raman and J. H. Agrawal

National Agricultural Research Project, Sub-Project
(Arnej), Gujarat Agricultural University

The present-day investigations indicate that the Indian soils are generally found deficient in nitrogen and almost sufficient in potash (Kanwar, 1976), so application of nitrogenous fertilizer is always being recommended while potash is not, even without testing the soils for their availability. However, phosphorus is always required to be estimated before sowing of any crop.

Phosphorus estimation in soils and plant has been since decades done over costly instruments like spectro-photometer or colorimeter. In addition to the cost factor another limitation in its use is the availability of an established laboratory (with power supply) and poor mobility as these instruments can not be taken to the field.

In view of the above limitation, the scientists at Jawaharlal Nehru Krushi Vishwa Vidyalaya, Jabalpur have designed and constructed a prototype of a simple, easy to operate, portable, low-priced (material and component cost, excluding battery, approx. Rs. 800/- as in 1980) phosphorimeter for determination of available phosphorus in soils. It gives readings directly in terms of very low, low, medium, high and very high status of phosphorus. The phosphorimeter incorporates a double beam optical path, a matched pair of photocells with built-in 660 nm red filter, and solid-state IC amplifier. The instrument works on 12 volts and needs a wet battery used in motor vehicles.

In view of the above facts and for its adaptibility on a large scale in the field itself, the present study was initiated to evaluate the phosphorimeter for its efficiency against the standard instrument. Surface soil samples (228 nos.) from the *Bhal* and coastal region of Gujarat State were analysed for their available phosphorus content by Olsen's method (Jackson, 1973) using two instruments viz., Bausch & Lomb Spectronik-20 spectrophotometer (standard) and phosphorimeter (Fig. 1). The phosphorimeter was first tested for its obeyance of the Beer-Lambert's Law of colorimeter. Calibration of the phosphorimeter was accomplished by adjusting the needle at 80 on the dial using standard phosphate solution equivalent to 84 kg P_2O_5/ha. Standard curves for both the instruments (Fig. 2) were prepared by using definate quantity of phosphorus as suggested by Department of Agriculture, Gujarat State with slight modification in IARI ranges for grading the Gujarat soils and measuring the intensity of molybdophosphoric blue colour (Muhr *et al.*, 1965). From recommendation

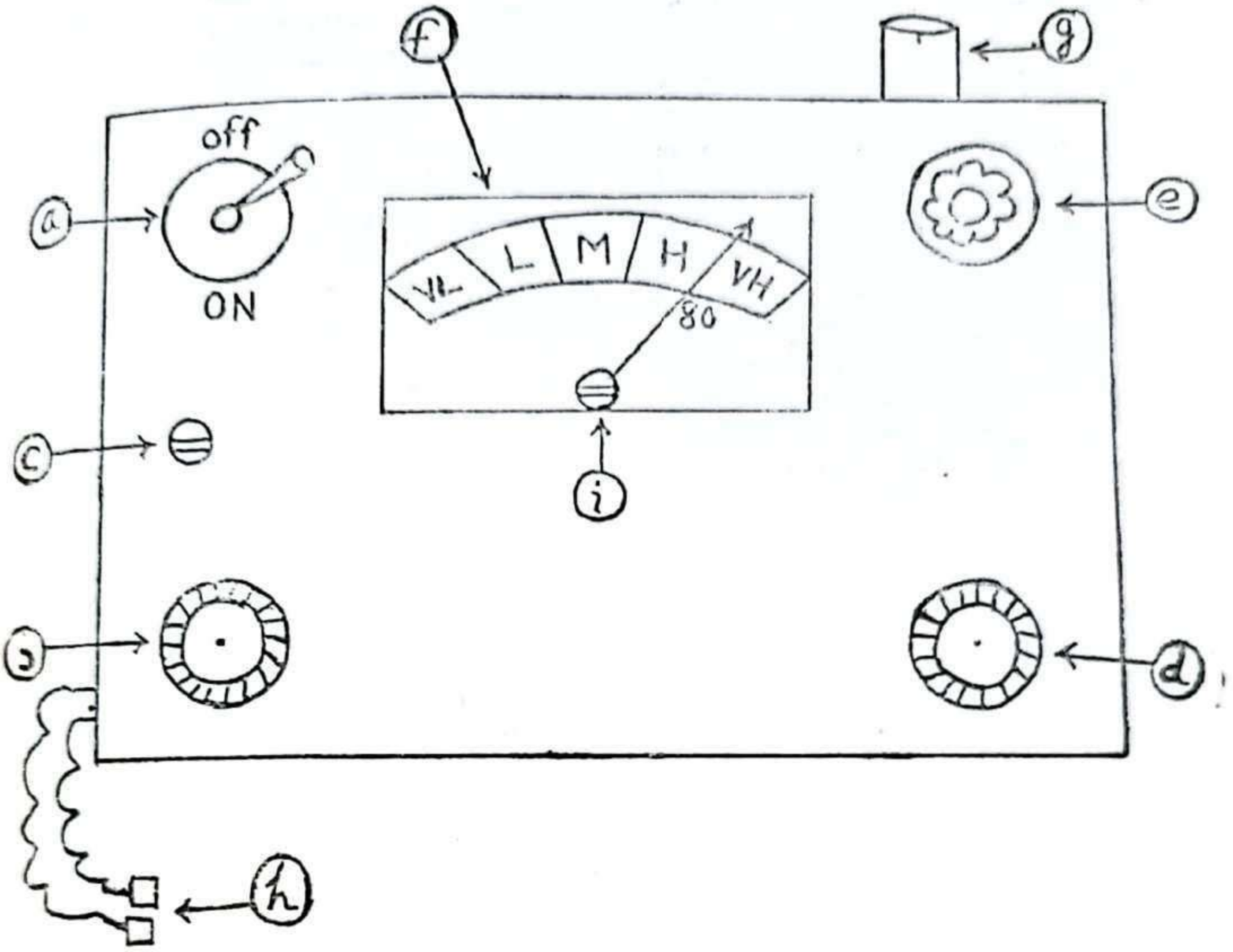
TABLE 1

Range and mean values of Olsen's P_2O_5 (kg/ha) of *Bhal* and coastal soils and their 'r' values for comparing two colorimeters.

Group	*High*		*Medium*		*Low*		*Very low*	
	A	*B*	*A*	*B*	*A*	*B*	*A*	*B*
Soil Samples	4	4	14	14	23	23	191	191
% Distribution	1.7	1.7	6.0	6.0	9.9	9.9	82	82
Range	56.8-77.28	58.69-74.37	28.26-52.28	31.81-55.5	14.89-26.26	18.82-27.8	0.81-15.86	0.89-16.27
Mean	69.17	69.66	39.37	43.73	20.09	24.93	5.31	6.82
Soil pH (1 : 2.5)	7.0-9.0		7.4-9.1		7.5-8.9		7.8-8.9	
'r' value	0.815 NS		0.992**		0.847**		0.45**	

Very High : More than 84 (non sample)
High : 56.0 — 84.0
Medium : 28.0 — 56.0
Low : 16.4 — 28.0
Very low : Less than 16.4
(All the figures in kg/ha)

A = Spectronik-20
B = Phosphorimeter
NS = Not Significant
** = Significant at 1% level.



ⓐ ON/off switch ⓑ Zero set
ⓒ Amplifier zero ⓓ Standardisation set
ⓔ Pilot lamp (red) ⓕ Meter for readout
ⓖ Insert for cuvette
ⓗ Pair of leads for battery (12V-Wet) Connection
ⓘ Mechanical zeroing for the meter

fig – 1 : Phosphorimeter

point of view, the marginal values (for grading the soil) were kept within the safe limits of recommendation (i. e. values shifted by 1 kg) and accordingly marked on the scale. The values for available psosphorus contents obtained by using both the instruments were compared using correlation test (Panse and Sukhatme, 1967). It is seen from Table 1 that the value for medium, low and very low groups was significant at 1% level, while it was not significant for the soils under high group, though the values fall within the range fixed for their proper group. The values for the phosphorimeter were slightly higher for all the groups as compared to the Spectronik-20. However, the predictibility remains the same.

From the results, it is revealed that this simple phosphorimeter may be recommended for use on the field where on the spot investigation of the phosphorus content is required. Due to its cost benefits and easy portability, this instrument would be ideal for a mobile soil testing laboratory.

(Received on 20th March 1987)

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GAU Res. J. 1990. 16 (1) : 57–59

Field Bioefficacy of Different Insecticides for the Control of Ber Fruit Fly, *Carpomyia Vesuviana* Costa. (Tephritidae : Diptera)

I. S. Patel, V. R. Upadhyay, H. N. Vyas and
A. T. Patel

All India Co-ordinated Fruit Improvement Project
(I.C.A.R.), Gujarat Agricultural University,
Sardar Krushinagar 385 506 (Gujarat)

Ber (*Zizyphus mauritiana* Lamk) is one of the important fruit trees in India and is attacked by fifty species of insect pest throughout the country (Wadhi and Batra 1964). Out of these, fruit fly, *Carpomyia Vesuviana* Costa (Tephritidae : Diptera) is one of the important pest which cause considerable damage resulting in the deterioration of quality and reduction in quantity of the fruit produce. Pruthi and Batra (1960) recorded it to be the most serious pest of ber in North West India. Being a serious pest of ber, orchards of this region, a field investigation was carried out at semi arid condition of Sardar Krushinagar (Gujarat) with a view to find out most effective insecticides for its control.

An experiment was conducted at experimental orchards under Fruit Improvement Project, Gujarat Agricultural University, Sardar Krushinagar during the year 1985-86. The insecticides *viz.,* Fenthion 0.03%, Methyl-O-demeton 0.03%, Monocrotophos 0.03%, Formothion 0.03%, Thiometon 0.03%, Malathion 0.07%, Quinalphos 0.05%, Phenthoate 0.05%, Methyl Parathion 0.03%, Phosalone 0.05%, Endosulfan 0.07%, Decamethrin 0.00125%, Phosphamidon 0.03%, Dimethoate 0.03%, were tested and compared with two untreated control *viz.,* A.T.T. (Away from treated tree) and N.T.T. (Near treated tree). All trees were thoroughly sprayed with the Knapsack Sprayer with the respective treatments. The observations of infested fruits were recorded by counting 100 fruits from four directions of each tree (North, South, West, East). The fruits possessing maggots, galleries or exit holes were considered as infested. The data on incidence of fruit fly (%) were statistically analysed and presented in Table-1.

The data presented in Table-1, revealed that the least incidence of fruit fly (8.83%) was recorded in Dimethoate 0.03% which was at par with Fenthion 0.03%, Phosphamidon 0.03% and Decamethrin 0.00125% with 11.86, 14.90 and 14.95% incidence respectively. In other treatments, incidence ranged from 15.44% (Malathion 0.07%) to 18.98%) (Formothion 0.03%) and were equally effective. Endosulfan 0.07% recorded maximum incidence i.e., 20.50% and found least effective. Both the control treatments i.e., A.T.T. and N.T.T. recorded 41.54 and 30.56% infestation, respectively and it was significantly imferior to insecticidal treatments. Further, among the untreated (control) treatments, N.T.T. recorded least incidence

TABLE I

Efficacy of different insecticides for the control of ber fruit fly, *Carpomyia vesuviana* Costa

Sr. No.	*Treatments*	*Concentration tested (%)*	*Mean incidence (%)*
1.	Fenthion	0.03	11.86 (4.1)
2.	Methyl-0-demeton	0.03	15.87 (7.5)
3.	Monocrotophos	0.03	16.68 (8.2)
4.	Formothion	0.03	18.98 (10.6)
5.	Thiometon	0.03	17.62 (9.2)
6.	Malathion	0.07	15.44 (7.1)
7.	Quinalphos	0.05	18.16 (9.7)
8.	Phenthoate	0.05	16.75 (8.3)
9.	Methyl Parathion	0.03	17.56 (9.1)
10.	Phosalone	0.05	17.22 (8.7)
11.	Endosulfan	0.07	20.50 (12.3)
12	Decamethrin	0.00125	14.95 (6.7)
13.	Phosphamidon	0.03	14.90 (6.6)
14.	Dimethoate	0.03	8.83 (2.3)
15.	A.T.T. (control)	—	41.54 (44.0)
16.	N.T.T. (control)	—	30.56 (25.8)
		S. EM (±)	1.64
		CD (P=0.05%)	4.63
		CV (%)	17.06

(Figures in parentheses are retransformed values, those outside are angular transformed values).

A.T.T. : Away from treated tree.

N.T.T. : Near treated tree.

than the A.T.T., which may be due to drifting effect of insecticides to the untreated trees.

From these results, it is concluded that among all tested insecticides, Dimethoate 0.03%, Fenthion 0.08%, Phosphamidon 0.03% and Decamethrin 0.00125% were found to be most promising insecticides. The performance of Dimethoate in the present investigation was in confirmity with the results reported by Bakhshi and Singh (1974) while, Singh *et al.* (1973), Saxena (1968) and Lakra and Singh (1981) recommended malathion to be the best treatment for controlling this pest.

ACKNOWLEDGEMENT

The authors are highly thankful to Dr. O. P. Pareek, Project Director (Fruit), Haryana Agricultural University, Haryana for providing necessary technical informations.

(Received on 14th April, 1988)

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GAU Res. J. 1990. 16 (1) : 60–62

Groundnut Response to Growth Regulators

J. D. Gundalia, M. S. Patel, M. H. Patel and P. G. Vadher

Department of Agricultural Chemistry & Soil Science, Gujarat Agricultural University, Junagadh Campus, Junagadh-362 001

Spectacular results have been reported on the effect of hormones on fruit crops especially ber (*Zizyphus mauritina* Lamk) in Saurashtra region of Gujarat (Patel and Patel, 1979) and also on groundnut elsewhere (Dasgupta, 1975; Gardner, 1983; Reddy and Patil, 1981). Groundnut being the principal crop of the region, no information on the effect of hormones on yield of this crop is available. A pot experiment was therefore, conducted to study the effect of different growth retardants and growth promoters at two concentrations on growth, yield and quality of groundnut (*Arachis hypogaea* L.) variety 'GAUG 1'.

The experiment was conducted in earthen pots of 45 cm diameter and 40 cm deep during 1982. Each pot contained 30 kg clay soil which had pH 7.9, EC 0.50 mmhos/cm, $CaCO_3$ 38 per cent, organic C.O. 88 per cent, available P 45 kg P_2O_5/ha and available K 370 kg K_2O/ha. The soil was well mixed with a basal dose of 20 ppm N and 40 ppm P as urea + diammonium phosphate. Seven bold and healthy thirum treated seeds were sown in each pot, but a week after germination they were thinned to three. The treatments consisted of five hormones each at two concentrations, besides two contorls (Table 1). Each hormone was applied at 40 and 60 days after sowing. The crop was irrigated as and when required until 7 days before its harvesting at maturity. The ancillary observations such as length of internode, length of side branch, plant height, shelling percentage, pod and haulm yields were recorded. Protein and oil contents from kernel were also determined using standard procedures as described in A. O. A. C. (1950).

The data (table 1) show that CCC and SADH significantly decreased the length of internodes and side branches, whereas reverse was true in case of GA_3 and IBA. The results suggest that the auxin activity in the plant might have been inhibited due to the application of the growth retardants which act more or less as antiauxins. Similar reduction in size of side branches due to growth retardants was reported by Reddy and Patil (1981). Gardner (1983) also noted retardation in vegetative growth of groundnut due to SADH.

Spraying of IBA @ 25 ppm and GA_3 @ 50 ppm significantly increased plant height. Spray of water alone also enhanced while that of SADH @ 500 ppm retarded the plant height, but these treatments failed to reach the level of significance over control.

In general, an increase in the pod yield ranged from 10 to 55 per cent due to different hormone treatments over absolute control. The highest pod yield was recorded with the treatment IBA @ 50 ppm followed by GA_3 @ ppm and IBA @ 25 ppm, which were at par with each other, but significantly superior to absolute control. The treatment of SADH @ 500 ppm also produced significantly higher pod yield over absolute control. The maximum haulm yield was noted with the application of CCC @ 100 ppm, followed by GA_3 and IBA at both the levels, which were at par with each other. However, all these treatments proved significantly superior over control.

Shelling percentage was not affected by the treatments, however, they followed the similar trend in respect of test weight and oil yield. Dasgupta (1975) observed significant superiority of CCC @ 500 ppm over control in increasing pod and oil yield.

A significant improvement in protein content was recorded with spray of only SADH at both the levels over control, the maximum value of 19.8 per cent was with its 500 ppm level. IBA @ 25 ppm out yielded the other treatment except CCC at both levels in respect to oil content in kernel.

Among all the hormone treatments, spraying of IBA @ 25 ppm over control gave maximum net ICBR of 4.08. Although spraying of IBA @ 50 ppm gave net ICBR of 3.58 next in order, it gave the maximum net return among all the treatments. Thus, considering effect of IBA on quality and yield it may be concluded that spraying of this hormone @ 50 ppm and 60 days after sowing would be profitable.

(Received on 15th Febru. 1988)

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TABLE 1

Mean effect of different hormone treatments on growth, yield and quality of groundnut.

Treatment	*Average internode length (cm)*	*Average length of side branch (cm)*	*Average plant height (cm)*	*Yield (g/pot)*			*Shelling (%)*	*Protein content (%)*	*Oil content (%)*	*Oil yield (g/pot)*	*Net ICBR*
				Pod	*Haulm*	*Harvest index (%)*					
Control (Absolute)	2.2	23.0	19.3	20.0	24.3	45.1	74.4	17.3	46.0	6.8	—
Control (Only water spray)	2.3	27.0	23.0	20.9	27.9	42.8	74.9	18.7	47.5	7.5	—
SADH @ 250 ppm	1.4	19.3	17.0	24.7	30.7	44.6	74.6	19.0	45.9	8.4	—
SADH @ 500 ppm	1.4	19.2	15.3	25.6	32.4	44.1	74.6	19.8	46.3	8.8	—
CCC @ 50 ppm	1.4	22.8	21.7	22.8	32.4	41.3	75.7	18.4	48.6	8.3	—
CCC @ 100 ppm	1.8	31.3	22.7	22.3	35.6	38.5	74.5	17.6	48.7	8.1	—
GA_3 @ 25 ppm	2.9	32.2	24.0	24.1	35.4	40.5	74.3	16.7	47.4	8.5	—
GA_3 @ 50 ppm	3.3	31.7	26.0	27.9	35.5	44.0	74.0	17.6	48.3	10.0	0.02
NAA @ 40 ppm	2.5	23.7	18.7	22.0	28.6	43.5	75.0	17.3	47.0	7.7	—
NAA @ 80 ppm	2.9	21.3	20.0	21.9	28.6	43.4	75.0	18.4	47.0	7.7	—
IBA @ 25 ppm	3.1	34.0	26.7	26.2	33.1	44.2	74.5	18.7	49.4	9.6	4.08
IBA @ 50 ppm	2.9	29.0	21.7	30.9	34.7	47.1	75.0	18.7	46.7	10.7	3.58
S. Em. ±	0.2	1.57	1.56	1.76	2.30	1.30	0.44	0.56	0.20	0.55	
C. D. @ 5%	0.7	4.54	4.50	5.10	6.68	3.76	N. S.	1.63	0.60	1.60	
C. V. %	17.0	10.0	10.0	12.0	12.5	12.0	10.0	5.0	1.0	11.0	

Note : Relative economics (Net ICBR) of the treatments have been worked out for only those treatments which showed significant superiority in both pod and haulm yield over absolute control. Plant polution was assumed to be 1.5 lakh plants/ha and the amounts of solution for 1st and second spray were to be 250 and 350 litres/ha.

The prices considered were : Pod Rs. 500 per q, Haulm Rs. 40 per q, SADH Rs. 20 per g, CCC Rs 7 per g, GA_3 Rs. 70 per g, NAA Rs. 5 per g, IBA Rs. 20 per g. Cost of spray Rs. 20 per spray.

GAU Res. J. 1990. 16 (1) : 63–66

Effect of Different Leaves of Phosphorus and Zinc on Yield and Nutrient Uptake of Groundnut and Maize (Fodder)

M. S. Patel and R. G. Patil

Department of Agricultural Chemistry and Soil Science, College of Agriculture, Gujarat Agricultural University, Junagadh Campus, Junagadh-362 001

A field trial was conducted on a cultivator's field in *kharif* 1979 with groundnut GAUG 10 variety and in *rabi* 1978-80 with maize Ganga Safed as fodder to study the effect of phosphorus and zinc on yield and nutrient uptake by these crop grown in rotation on fixed plots. The treatment consisted four levels (0, 25, 50 and 75 kg P_2O_5/ha) of phosphorus and two levels (0 and 20 kg Zn/ha) of zinc which were arranged in a randomised block design with four replications. Besides the required dose of P and Zn as per treatments. a basal dose of 25 kg N/ha as urea was given to groundnut and maize crops, respectively. In case of maize, 50 kg N as urea was topdrsesed at knee high stage. P was applied as single superphosphate and Zn as $ZnSo_4$. The soil was calcareous in nature and clayey in texture with pH (1:2.5) 7.8 and EC (1:2.5) 0.35 mmhos/cm. It contained 0.92% organic carbon, 7.8 kg P_2O_5/ha Olsen's P, 451 kg K_2O/ha NH_4OAc extractable K and 0.68 ppm DTPA extractable Zn. groundnut was harvested at maturity, while maize at milk stage. Pod and haulm yield of groundnut and dry fodder yield of maize were recorded. Plant samples collected at harvest were analysed for N, P and K by standard precedures as described by Jackson (1973).

The data in Table 1 indicate that neither application of P nor of Zn alone was effective in increasing kernal, shell and straw yield except that of P which significantly incressed kernal yield. Application of 75 kg P_2O_5/ha gave the maximum kernal yield of 560 kg/ha which was at par with that produced with 50 kg P_2O_5/ha, but significantly superior to that with 0 and 25 kg P_2O_5/ha levels. Hovever, the effect of the dose of 50 kg P_2O_5/ha was at par with that of 25 kg P_2O_5/ha.

The applied P at all levels significantly increased fodder yield of maize over control. Fertilization with 50 kg P_2O_5 partically did not increase fodder yield over 25 kg P_2O_5/ha but again raising this dose to 75 kg P_2O_5/ha increased fodder yield to the tune of 28 per cent over that of 25 kg P_2O_5/ha.

The application of 50 kg P_2O_5/ha and above significantly improved the uptake of N. P and K by kernal but it failed to produce significant effect on uptake of these nutrients by shell and haulm except P uptake by shell where significantly maximum uptake was recorded with 25 kg P_2O_5. It is interesting to note that fertilization of maize with 25 and 75 kg P_2O_5/ha over control significantly

TABLE 1

Groundnut and maize fodder yield as influenced by different levels of phosphorus and zinc.

P levels kg P_2O_5/ha.	*Groundnut (kg/ha)*			*Maize fodder (q/ha)*
	Kernel	*Straw*	*Shell*	
0	360	5075	304	62
25	446	5250	335	100
50	469	5149	332	101
75	560	5463	363	128
C. D. at 5%	106	N. S.	N. S.	19
Zn levels kg Zn/ha.				
0	456	5204	340	99
20	462	5264	327	96
C. D. at 5%	N. S.	N. S.	N. S.	N. S.

improved N and P uptake and only the latter dose improved K uptake.

The effect of Zn application yield and nutrient uptake of both the crops was non-significant (Table 1 & 2). This non significant effect can be attributed to slightly higher amount of DTPA extratable Zn (0.68 ppm) than suggested critical limit of 0.06 ppm (Dangarwala *et al.*, 1983).

Significant interacting effect of phosphorus X zinc was observed only on halum yield (Table 3). In the absence of Zn, application of 75 kg P_2O_5/ha produced the lowest halum yield (4861 kg/ha). however when this dose of P was incorporated with 20 kg Zn/ha, it gave maximum yield (6064 kg/ha). The results suggest that crop demand for Zn increase at higher dose of P. However, this higher production of dry matter was not reflected in pod yield.

From the above results it can be concluded that groundnut and maize show differential response to P fertilization in P deficient soil but they do not respond to Zn fertilization in the soil supplied with adequate amount of available zinc. However, higher dose of P may demand more Zn for dry matter production

(*Received on 4th April, 1989*)

TABLE 2

Nutrient uptake by groundnut and maize as influenced by different levels of phosphorus and zinc.

P levels kg P_2O_5/ha	*Nutrient uptake (kg/ha*														
	Kernel			*Haulm*			*Shell*			*Total*			*Maize fodder*		
	N	*P*	*K*	*N*	*P*	*K*	*N*	*P*	*K*	*N*	*P*	K	*N*	*P*	*K*
0	9.6	1.3	2.5	117	16.5	73	3.7	0.2	3.9	130	18.0	79.4	53	3.5	122
25	12.2	1.6	3.1	142	15.0	74	4.9	0.5	4.7	159	17.1	81.8	118	9.0	172
50	14.7	1.9	3.3	132	16.4	71	4.9	0.3	4.3	152	18.6	78.6	93	7.5	179
75	15.3	2.0	3.8	141	19.1	76	4.9	0.3	4.6	161	21.4	84.4	126	13.5	209
C. D. at 5%	2.97	0.52	0.79	N.S.	N.S.	N.S.	N.S.	0.12	N.S.	—	—	—	46	4.7	58
Zn levels kg Zn/ha															
0	12.4	1.6	3.2	134	17.2	71.9	5.1	0.7	4.5	152	19.5	79.6	101	7.3	172.6
20	13.5	1.7	3.2	131	16.3	74.6	4.1	0.6	4.3	149	18.6	82.1	94	9.5	168.0
C. D. at 5%	NS	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	NS	—	—	—	N.S.	N.S.	N.S.

TABLE 3

Interaction of phosphorus and zinc on haulm yield (kg/ha) of groundnut.

Phosphorus P_2O_5 kg/ha	*Zinc*	
	0	*20 kg/ha*
0	5151	4998
25	5686	5015
50	5318	4981
75	4861	6064
C. D. at 5%	958	

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લક્ષ્મીનું બળણું વરદાન સુફલા અને ઊજ્જવલા

ઉજ્જ્વલા
યુરિયા
૪૬.૪ % નાઈટ્રોજન

સુફલા

રાષ્ટ્રીય કેમિકલ્સ ઍન્ડ ફર્ટિલાઈઝર્સ એશિયાભરમાં ફર્ટિલાઈઝરનો સૌથી મોટો પ્લાન્ટ છે. આર.સી.એફ. નાં ટ્રોમ્બે તથા થળ ખાતેનાં બંને એકમોમાં વાર્ષિક લગભગ ૨૦ લાખ ટન ઉજ્જ્વલા યુરિયાનું ઉત્પાદન કરાય છે.

સ્ફટિક જેવું શુભ્ર, દાણાદાર, વાસરહિત અને અદ્યતન પદ્ધતિથી બનાંવવામાં આવતું ઉજ્જ્વલા યુરિયા ખેડૂતોમાં ખૂબજ લોકપ્રિય છે.

ઉજ્જ્વલામાં બાયયુરેટસનું પ્રમાણ ઓછું હોવાથી એ બધાયે પાકો માટે વધુ લાભદાયી નીવડે છે. ૪૬.૪ ટકા નાઈટ્રોજનનું તત્વ ધરાવતું ઉજ્જ્વલા યુરિયા બીજાં ખાતરો-ફર્ટિલાઈઝરો અને જંતુનાશકોમાં ભેળવીને પણ વાપરી શકાય છે.

ઉજ્જ્વલા તથા સુફલા ફર્ટિલાઈઝરો વાપરતાં પહેલાં આર.સી.એફ.ની અમરાવતી, કોલ્હાપુર અને ટ્રોમ્બે ખાતે આવેલી માટી-ચકાસણીની પ્રયોગશાળામાં માટીના નમુનાની વિનામૂલ્ય ચકાસણી કરાવીને ભલામણ મુજબ સંતુલિત પ્રમાણમાં ફર્ટિલાઈઝરો વાપરવાં. સામાન્ય રીતે, બાજુમાં આપેલ કોઠા અનુસાર ફર્ટિલાઈઝરો વાપરી શકાય

હેક્ટર દીઠ પ્રમાણ (ગુણી)

પાક	ઉજ્જ્વલા યુરિયા ૪૬.૪%/નાઈટ્રોજન	સુફલા ૧૫:૧૫:૧૫
ડાંગર	૨	૭
જુવાર	૩	૮
કપાસ	૨	૭
શેરડી (સુરૂ)	૬	૧૫
(આડ વર્ષે)	૧૦	૨૩

સુફલાનું આ અદ્ભુત સર્જન
ઉજ્જ્વલા યુરિયા અર્પે ખૂબ ધન
ચાલો, લાવો સુફલા આજે
ભરપૂર ઉત્પન્ન લેવા કાજે.

રાષ્ટ્રીય કેમિકલ્સ ઍન્ડ ફર્ટિલાઈઝર્સ લિમિટેડ
(ભારત સરકારનું અંગીકૃત ઉદ્યોગસાહસ)

Sobhagya/RCF/90 Guj