

INFLUENCE OF IRRIGATION SCHEDULING, METHODS OF IRRIGATION AND NITROGEN LEVELS ON GROWTH AND YIELD OF MAIZE

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ABSTRACT

Investigations were carried out in a split plot design replicated thrice with two levels of irrigation (0.50 IW/CPE ratio and 0.75 IW/CPE ratio), three methods of irrigation (all furrow method, alternate furrow method and paired skip furrow method) and three levels of nitrogen (75, 125 and 175 kg N ha⁻¹). The growth characters like plant height and the yield attributes like cob length, cob width, number of grains cob⁻¹ and hundred grain weight were significantly increased with increase in IW/CPE ratio from 0.50 to 0.75 and with each successive increment of nitrogen. All furrow method of irrigation recorded highest growth and yield characters compared to alternate and paired skip furrow method of irrigation. Significantly highest grain and stover yields were recorded under 0.75 IW/CPE ratio with all furrow method of irrigation and at application of 175 kg N ha⁻¹.

Maize is an important grain crop in many parts of the world. Moisture and N are the primary factors limiting the maize productivity. But relatively little work has been done to improve its actual practices under subtropical and tropical countries. Most of the work on irrigation is based either on critical stage or soil moisture depletion without incorporating climatic parameters. According to Prihar *et al.* (1976) IW/CPE ratio concept has been found a reliable, economical and practical basis for scheduling irrigation.

The conventional flat bed method of irrigation resulted in excess application of water and less water use efficiency. Current constraints on the

availability of irrigation water and fertilizer have prompted studies aimed at economizing their use without affecting production. The present studies aimed at investigating the independent and combined effects of irrigation levels, methods of irrigation and N on the growth and yield of maize.

MATERIALS AND METHODS

A field experiment was conducted for two seasons namely *kharif* and *rabi* 1989 with Co 1 maize on a deep, moderately well drained sandy clay loam soil at Coimbatore. The initial soil analysis showed low in available N (198 and 161 kg N ha⁻¹ for *kharif* and *rabi* respectively), medium in

Table 1. Influence of treatments on plant height and yield attributes of maize in *kharif* and *rabi* seasons.

Treatments	Plant height (cm)		Cob length (cm)		Cob width (cm)		Number of grains /cob ⁻¹		Hundred grain weight (g)	
	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>
I ₁	189.53	192.31	14.78	14.98	4.26	4.42	279.24	292.82	23.81	27.60
I ₂	199.10	205.60	16.17	16.44	4.96	5.05	339.40	373.29	25.95	30.66
SE	0.11	0.34	0.01	0.03	0.01	0.04	0.80*	0.82	0.02	0.03
CD (5%)	0.35	1.07	0.04	0.10	0.02	2.59	2.53	2.59	0.08	0.11
S ₁	195.53	201.91	15.74	16.16	4.71	4.90	319.89	348.83	25.32	29.68
S ₂	195.31	200.65	15.72	16.08	4.70	4.81	317.84	346.49	25.25	29.76
S ₃	192.12	194.31	14.97	14.96	4.41	4.50	290.73	303.85	24.08	27.89
SE	0.13	0.42	0.01	0.04	0.01	0.04	0.98	1.01	0.03	0.04
CD (5%)	0.41	1.31	0.04	0.18	0.02	0.14	3.10	3.17	0.10	0.12
N ₁	190.08	194.84	15.05	14.85	4.40	4.49	290.78	310.16	23.89	27.41
N ₂	194.63	199.89	15.59	15.86	4.67	4.78	312.85	337.23	25.14	29.38
N ₃	198.23	202.13	15.79	16.39	4.76	4.93	324.33	351.78	25.61	30.60
SE	0.19	1.28	0.01	0.04	0.01	0.03	1.15	1.14	0.12	0.08
CD (5%)	0.56	3.72	0.04	0.13	0.03	0.10	3.23	3.33	0.34	0.23

Interaction NS* NS - Not Significant.

available P and high in available K. Investigations were carried out in a split plot design replicated thrice with following treatments.

I. Main plot

A. Irrigation levels

- a. Irrigation at IW/CPE ratio of 0.50 - I₁
- b. Irrigation at IW/CPE ratio of 0.75 - I₂

B. Methods of irrigation

- a. All furrow method - S₁
- b. Alternate furrow method - S₂
- c. Paired skip furrow method - S₃

II. Sub plot

Nitrogen levels (N)

- a. 75 kg N ha⁻¹ -N₁
- b. 125 kg N ha⁻¹ -N₂
- c. 175 kg N ha⁻¹ -N₃

RESULTS AND DISCUSSION

The results are presented in Table 1 and 2 for *kharif* and *rabi* seasons. Irrigation levels, methods of irrigation and N levels influenced the growth and yield characters throughout the crop growth period in both the seasons. Irrigation scheduled at 0.75 IW/CPE ratio (I₂) recorded higher plant height, yield components and yield than irrigation scheduled at 0.50 IW/CPE ratio (I₁) in both the seasons. Increased frequency of irrigation and increase in total amount of water supply led to effective absorption and utilization of nutrients resulting in quick growth. The significant effect of moisture deficit on plant height was noticed by May and Milthorpe (1962). All furrow method (S₁) recorded maximum plant height and yield attributed which were on a par with alternate furrow method of irrigations (S₂). But the grain yield under all furrow method of irrigation significantly differed from alternate furrow (S₂) and paired skip furrow (S₃) methods of irrigation. Increased growth characters, yield attributes, and yield under all furrow method of irrigation was due to increased available soil moisture from both the sides of the furrows. Higher available soil moisture increased the cell turgor which led to effective physiological process like cell division and cell elongation.

Application of 175 kg N ha⁻¹ (N₃) recorded maximum growth, yield components and yield. The increase in grain yield under 175 kg N ha⁻¹ and

Table 2. Influence of treatments on grain yield and stover yield (kg ha⁻¹).

Treatments	Grain yield kg ha ⁻¹		Stover yield kg ha ⁻¹	
	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>
I ₁	3898	3922	6567	6554
I ₂	4680	4792	7313	7824
SE	12	18	21	26
CD (5%)	38	54	64	78
S ₁	4428	4553	6995	7469
S ₂	4396	4448	7039	7318
S ₃	4044	4070	6788	6782
SE	12	21	14	27
CD (5%)	36	62	41	80
N ₁	3960	4054	6564	6747
N ₂	4348	4389	7056	7247
N ₃	4560	4627	7203	7574
SE	22	41	27	51
CD (5%)	68	124	81	148
Interaction	NS*			

*NS - Not Significant.

15.15 and 14.13 per cent over 75 kg N ha⁻¹ during *kharif* and *rabi* respectively. Nitrogen fertilization increased the physiological process of crop plants and N deficiencies can alter the physiological response of maize. Lorens *et al.* (1987) reported that when water stress was severe, water became the limiting input and N level had little effect on growth characters.

Water use efficiency was higher under 0.50 IW/CPE ratio, which recorded 4 and 5 irrigations during *kharif* and *rabi* seasons respectively. Whereas I₂ (0.75 IW/CPE ratio) recorded 7 and 8 irrigations under the respective seasons. The calculated effective rainfall showed that higher amount of rainfall was used under the IW/CPE ratio of 0.50 in both the seasons. Total water used under I₂S N₃ combination was highest for both *kharif* and *rabi* seasons (553.6 mm and 529.2 mm for *kharif* and *rabi* respectively). Average water requirement under all furrow method is 495 mm and 464 mm for *kharif* and *rabi* respectively, whereas it is only 368 mm and 317 mm under alternate furrow method of irrigation. The grain yield was 4.42 and 4.39 tonnes during *kharif* and 4.55 and 4.45 tonnes during *rabi* under all furrow and alternate furrow method of irrigation respectively. Here it is evident that there is not much difference between all furrow and alternate

furrow method of irrigation even though the water requirement for alternate furrow method of irrigation is 60-70 per cent of the all furrow method of irrigation.

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PRODUCTION POTENTIAL OF COMPATIBLE FODDER CEREAL-LEGUME MIXTURES IN THE NORTH WESTERN ZONE OF TAMIL NADU

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ABSTRACT

Field experiments were carried out to evaluate the production potential of cereal-legume fodder combinations in the North Western Zone of Tamil Nadu having red sandy loam soils at RRS, Paiyur in 1987 and 1988. Cereal fodders like sorghum, maize, pearl millet and finger millet and legume fodders such as cowpea and soybean were raised as pure and in 1:1 and 2:1 ratios. The experimental results indicated that maize cowpea in 1:1 combination produced 27 tonnes of green fodder with higher per day productivity and protein yield under irrigated conditions.

Agroclimatically North Western Zone of Tamil Nadu comprises Dharmapuri and Salem Districts, predominantly having red sandy loam soil under semiarid farming. Farming in this zone is a mixed enterprise of crops and livestock. The fodder availability is estimated to be around 30.9 lakh tonnes of dry fodder and 4.2 lakh tonnes of green fodder. Estimation has also brought out a deficit of 23.8 lakh tonnes of dry fodder (43.5%) and 10.7 lakh tonnes of green fodder (71.8%) in the North Western zone for productive maintenance of livestock component (Anon.1984).

Raising combination of fodder crops, instead of monocrop of either cereal or legume fodder, would provide a scope for higher yield and good quality fodder. Hence, to increase the fodder production and also to produce highly nutritious and balanced feed for livestock, elaborate study needs to be undertaken.

MATERIALS AND METHODS

Field studies were undertaken to evaluate the best combination of fodder cereal-legume mixtures to obtain higher green fodder yield with better quality under irrigated conditions at Regional Research Station, Tamil Nadu Agril. University,

Paiyur during 1987 and 1988. Experiments were carried out in red sandy loam soils having low available nitrogen, medium available phosphorus and high available potassium. Fodder cereals, viz., sorghum, maize, pearl millet and finger millet and fodder legumes like soybean and cowpea were raised as mono as well as cereal-legume fodder mixtures in 1:1 and 2:1 ratios in randomized blocks design replicated thrice. Fodder crops were raised in 8 m x 5m plots with a spacing of 30 x 10 cm. Harvest was taken up at 50 per cent flowering and the data on green fodder, dry fodder and protein yields and per day fodder productivity were recorded.

RESULTS AND DISCUSSION

Data on greenfodder yield was recorded at harvest and the dry fodder was recorded after sun drying to bring the moisture content to 15-16 per cent. The data on green fodder and dry fodder yields are presented in Table 1.

Results on green fodder yield during 1987 indicated that raising maize + cowpea at 1:1 ratio or at 2:1 ratio resulted in higher (24 t ha⁻¹) green fodder yield. As a monocrop, fodder maize as well as fodder cowpea yielded about 19 tonnes of green