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Study on the influence of dryland technologies on rainfed maize (*Zea mays* L.)

N. SAKTHIVEL AND A. BALASUBRAMANIAN
Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore - 641 003, Tamil Nadu.

Abstract : A field experiment was conducted during the North East monsoon season of 1995-96 at Coimbatore to study influence of dates of sowing, land management practices and seed hardening techniques on rainfed maize (*Zea mays* L.). The experiment was laid out in split plot design taking time of sowing and land management practices in main plots and seed hardening techniques as subplot treatments. Observations on growth components, yield parameters and yield were recorded. The results showed that premonsoon sown crop recorded 40 per cent higher grain yield (3795 kg ha^{-1}) over monsoon sown crop (2678 kg ha^{-1}). Among the land management practices, ridges and furrows were superior in recording better growth and yield components. Significant response was not observed between seed hardening methods studied on maize grain yield.

Keywords: Sowing time, Land management, Seed hardening and Maize productivity

Introduction

With the increasing demand for food, oilseeds and pulses, by the ever-growing human population, a desire necessity now arises to utilize the untapped drylands effectively. The main constraint of the dryland agriculture is the moisture stress as a result of agro-climatic risks coupled with soil related problems. This complex situation brings the dryland production always unstable. Maize is a coarse grain cereal crop, even though it is old to irrigated situation, it is a new one to dryland agriculture. Time and labour in addition to water are the main constraints for the dryland farming, since the agricultural operation in dryland agriculture starts with monsoon rains. Premonsoon sowing offers some alternate solution since the premonsoon rainfall is effectively utilized for the germination and the establishment of the concerned crop. Conservation of profile soil moisture may be improved through different efficient land management practices like compartmental bunding, and broad bed furrows. Better utilization of such available soil moisture could be improved further through seed hardening with electrolyte solutions. Hence, this study was undertaken.

Materials and Methods

A field experiment was conducted at Tamil Nadu Agricultural University Farm, Coimbatore during North East monsoon season of 1995-96 under rainfed situation. A total quantity of 579.8 mm of rainfall was received in 27 rainy days during the cropping season. Rainfall was observed to be uniform in all the standard weeks of growing season i.e. from the date of sowing to 75 DAS for premonsoon sown crop and upto 60 DAS for monsoon crop. The soil of the experimental field was deep, moderately well drained, sandy clay loam with pH 7.6, organic carbon 0.410 per cent, low available N (169 kg ha^{-1}), medium available phosphorus (18 kg ha^{-1}) and high available potassium (423 kg ha^{-1}). The experiment was laid out in split plot design taking time of sowing and land management practices in main plots and seed hardening techniques as subplot treatments. Time of sowing involves premonsoon sowing (S_1) and monsoon sowing (S_2). Land management practices comprising of compartmental bunding (L_1), Broad bed and furrow (L_2), Ridges and furrows (L_3), Flat bed sowing and ridging on 30 days after sowing (Farmer's method) (L_4). Subplot treatments include three seed hardening techniques *viz.* (i) control (no hardening) (H_1), (ii) KH_2PO_4 2 per cent (H_2), (iii) KCl 2 per cent (H_3). Based on the 25 years meteorological records of the university campus, normal onset of North East monsoon was fixed during first week of October (40th standard week). Accordingly the time of sowing for premonsoon (37- 38th standard week) was fixed as fifteen days earlier to the normal onset of monsoon. The maize cultivar CO 1 was

Table 1. Effect of time of sowing, land management practices and seed hardening techniques on growth and growth parameters of maize under rainfed conditions

Treatments	Plant height (cm)	LAI	DMP (kg ha^{-1})	CGR (g m^{-2} day^{-1})	RGR (g m^{-2} day^{-1})	NAR* (g m^{-2} day^{-1})
S_1	211.30	5.55	10637	10.09	0.0112	0.0189
S_2	254.10	4.83	8534	2.88	0.0036	0.0067
CD (P=0.05)	11.39	0.35	125	0.47	0.0006	0.0017
L_1	234.20	5.16	9476	5.96	0.0068	0.0117
L_2	235.80	5.23	9576	6.42	0.0074	0.0131
L_3	236.90	5.22	8835	7.00	0.0078	0.0139
L_4	223.90	5.16	9456	6.57	0.0075	0.0125
CD (P=0.05)	NS	NS	177	0.66	NS	NS
H_1	232.70	5.21	9522	6.56	0.0075	0.0131
H_2	232.20	5.21	9611	6.37	0.0720	0.0127
H_3	233.30	5.15	9624	6.53	0.0074	0.0126
CD (P=0.05)	NS	NS	NS	NS	NS	NS

* Net Assimilation Rate

Table 2. Effect of time of sowing, land management practices and seed hardening techniques on yield and yield parameters of maize under rainfed conditions

Treatments	Cob length (cm)	Cob weight (g)	Number of grains cob^{-1}	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	HI**
S_1	15.60	125.88	395.50	3795	6153	0.38
S_2	14.40	80.73	280.50	2678	4275	0.38
CD (P=0.05)	0.65	1.08	11.03	258	384	NS
L_1	14.90	106.65	339.70	3125	4807	0.40
L_2	14.80	100.33	329.10	3283	5303	0.38
L_3	15.40	106.75	350.50	3362	5534	0.37
L_4	14.90	99.47	332.70	3177	5212	0.39
CD (P=0.05)	NS	1.53	NS	NS	NS	0.016
H_1	15.10	102.26	336.50	3171	5150	0.38
H_2	14.90	103.67	340.50	3288	5249	0.37
H_3	14.90	103.99	336.90	3251	5243	0.38
CD (P=0.05)	NS	0.99	NS	NS	NS	NS

** Harvest Index

aken as test crop. The treatments were replicated hrice. The data on various growth components, ield parameters and yield were statistically nalysed and presented.

Results and Discussion

Growth and growth parameters (Table 1)

The data on growth parameters of maize evealed that there was a significant difference between time of sowings. Premonsoon sown crop registered higher leaf area index (LAI), dry matter production (DMP), growth indices like crop growth rate (CGR) and relative growth rate (RGR). With the increase in LAI, the plants raised under premonsoon sowing were able to produce higher DMP. Patil *et al.* (1991) from their experimentation reported that the DMP was mostly dependent on LAI as a result

of increased photosynthates and increased physiological processes.

In the present investigation even though significant difference is not observed between the land management practices since rainfall was uniform in all the standard weeks from sowing to 75 DAS. The treatment ridges and furrows recorded higher values. This result is in conformation with findings of Thiagarajan, (1981) who has reported that soil moisture storage is higher in case of ridges and furrows compared to flat bed system under rainfed situation.

The absence of seed hardening effect on the maize crop growth characters might be due to uniform receipt of rainfall in all the standard weeks from the date of sowing to 75 DAS.

Yield and yield components (Table 2)

Distinct difference between premonsoon and monsoon sown crops with reference to yield components and grain yield was observed. The development of yield components namely cob length, cob girth etc., started from the stage of cob initiation. In the present investigation because of premonsoon sowing, there was no soil moisture stress observed upto 75 DAS. This might have helped the cob development very effectively without any short comings. On the other hand, the rainfall ceased on 60th day for monsoon sown crop resulted in shortage of 15 days rainfall at reproductive stage to face higher moisture stress comparatively over S_1. This resulted in reduced yield components of maize as reported earlier by Aujla *et al.* (1987). Both grain and stover yields were higher to an extent of 40 and 44 per cent, respectively under S_1 sown crop over S_2. With advancement in sowing by nature this crop had been given an opportunity to utilize all the environmental resources effectively. This argument was supported by Periathambi (1980). In this investigation eventhough the data were non significant on length of cob, number of grain per cob, grain and stover yield between land management practices studied, numerically higher values were recorded under ridges and furrows. Because of the negligible moisture stress situation yield parameters did not differ between the treatments studied (Balasubramanian and Subramanian, 1990).

Numerically higher yield components and yields were observed in seed hardening with KH_2PO_4 solution as compared to the crop in which seeds were not hardened.

From the experiment it is concluded that integrated dryland technologies for maize *viz.* premonsoon sowing with KH_2PO_4 hardened seed and adopting the land management practice like ridges and furrows resulted in higher grain and stover yield under rainfed situation.

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