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Influence of Different Irrigation Scheduling Practices on The Growth and Yield Performance of Maize (Zea mays L.) Variety Agaiti-2002

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Abstract
This paper presents the findings of the effect of some selected deficit irrigation scheduling practices on irrigated maize crop. Field Experiment was carried out during the 2013-14 to assess the influence of different irrigation scheduling on maize yield. Randomized complete block design (RCBD) was used, with three replicates. Three irrigation Intervals were implemented T^1=2 irrigations (1st 25 Days after Sowing and 2nd, 55 days after sowing, T^2=3 irrigations 1st, 20 days after sowing, 2nd, 40 days and 3rd, 60 days after sowing, T^3=4 irrigations 1st 20 days after sowing 2nd 35 days, 3rd 50 and 4th 65 days after sowing. The results shown that maize yield varied significantly ($P<0.05$) under different irrigation scheduling. The treatment T^2 resulted the best, plant height (173 cm), the number of green leaves (12.08), stem width (4.01 cm), and fodder yield (30580 kg.ha^{-1}) Whereas T^3 resulted in the finest seed germination (86.91%). Finally, T^2 irrigation Interval was recorded effective to produce a higher fodder yield in maize and the farmers may assume this treatment to acquire high fodder production from maize.
Keywords: Maize, Variety, Irrigation Scheduling, Practices, Performance, growth and yield

1. Introduction 1

Maize (Zea mays L.) is an important cereal crop of Pakistan and it is increasingly gaining an important position in crop husbandry because of its higher yield potential and short growth duration. It is a rich source of food and fodder. Maize constitutes 6.4 % of the total grain production in the country, and occupies a special position in the national economy, as it is a good source of food, feed and fodder (Abdullah et al., 2007). Maize is one of the most important cereal crops of the world as well of Pakistan; it contributes 2.2 percent to the value added in agriculture and 0.5 percent to GDP. Maize was cultivated in an area of 1085 thousand hectares in 2012-13, less by 0.2 percent over last year's area of 1087 thousand hectares. However, the production witnessed 4631 thousand tons during 2012-13 against the last year production of 4631 thousand tons, suggesting an increase of 6.8 percent over the last year. The yield per hectare in 2012-13 stood at 4268 kg ha-1 posted appositive growth of 6.9 percent as compared to 4.9 percent growth last year. The production increased due to the conversion of more area to hybrid varieties of seeds and favorable weather conditions that has enhanced the yield of maize (GOP, 2013).Maize is broadly adaptable to varying climatic and soil conditions. In view of its increasing importance for fodder as well as grain, improvement in maize has picked considerable attention in the world (Ahsan and Mehdi, 2000). Fodder shortage is considered a major limiting factor for the development of the livestock industry in Pakistan and this problem was identified long ago in the feed balance sheet (Sial and Alam, 1998). In this scenario, vertical improvement of fodder production could be achieved by maximum increasing fodder yield per unit area of fodder crops through management practices, (Bhatti, 1996).

Irrigation scheduling is a technique to timely and precisely give water to a crop. (Jensen 1980) referred to irrigation scheduling as "a planning and decision-making activity that the farm manager or operator of an irrigated farm is involved in before and during most of the growing season". Irrigation scheduling has been described as the primary tool to improve water use efficiency, increase crop yields, increase the availability of water resources, and provoke a positive effect on the quality of soil and groundwater (FAO, 1996). The technique of using pan Evaporation for irrigation scheduling has been extensively tested by many researchers in Egypt (Khalil, 1996; Ashraf et al., 2002; Khalil et al., 2006) and it was proven to save up to 20% of the applied irrigation water by farmers. As the water resources of the world dwindles and compete for a better portion of the fresh water of irrigated agriculture e, domestic, industries, and environmental ways get stiffer, several suggestions are being made by water and d irrigation stakeholders on how irrigated agriculture can maximize production e production with minimum water so as to release water for other water users. One of such suggestions is deficit irrigation scheduling. It is believed that at field level, reducing evapotranspiration through deficit irrigation (less number of irrigation) and identifying the most sensitive crop growth stage of water stress is one of the ways to enhance crop productivity with less water (Maloti et.al 2006). Deficit irrigation is a scheduling method where irrigation is purposefully carried out not to fully meet water requirements s of the crop, and plants are allowed to extract soil moisture yonder readily available water in the plant root zone. Under deficit irrigation, crops are intentionally allowed to sustain some water deficit which may thus lead to yield reduction

(Smith et al. 2002; Prichard et al. 2004; Zhang et al. 2004). The goal of deficit irrigation is to increase crop water use efficiency (WUE) by reducing the amount of water at irrigation or by reducing the number of irrigation events (Kilda 2002).

*1.1 **Material and Methods**2*

A field study was carried out in the experimental fields of the student's farm, Department of Agronomy, Sindh Agriculture University, Tandojam during Kharif, 2013-14 in order to examine the yield of maize under the influence of different irrigation scheduling in a three replicated Randomized Complete Block Design having net plot size of 3 m × 3 m (9 m^2). The land was prepared by giving two dry plowings followed by precision land leveling. After soaking dose, when soil came in condition two plowings with crosswise cultivator followed by planking was applied to achieve the fine seed bed. The seed of maize variety Agaiti-2002 was sown with the help of single row hand drill. 30 cm. Nitrogen fertilization (N) was applied in the form of urea, Phosphor (P) in the form of single super phosphate (SSP), and potassium (K) in the form of sulphate of potash (SOP). The crop was irrigated as planned. 1/3 of N (as urea) along with all P and K were applied at the time of sowing and remaining N was applied in two splits, the first split at first irrigation and the 2nd split after 25 days of first one.

1.1.1 **STATISTICAL ANALYSIS**3

The data were statistically analyzed through MSTATC computer software. The LSD value for mean comparison was calculated only if the general treatment F test was significant at a probability of ≤ 0.05 (Gomez and Gomez, 1984.

1.1.2 **Results and Discussion** 3

Seed germination (%)

The results related to seed germination percentage of fodder as influenced by different irrigation a scheduling is given in Fig.1 and analysis of variance as Fig 1. The analysis of variance suggested non-significant (P>0.05) effect of various irrigation intervals on seed germination percentage of maize. It is seeming from the results (Fig.1) that relatively higher seed germination percentage (88.38%) on average was recorded in T3, when the crop was given Four irrigations (1st, 20 DAS, 2nd, 35 DAS, 3rd 50 and 4th 65 DAS); while the treatment T2 resulted average seed germination of 83.11 percent. Similarly, T2 treatment resulted average seed germination of 83.16 percent. However, the seed germination was lowest (80.17%) in T1 treatment. It was observed that the treatment T3 demonstrated to be an effective irrigation scheduling, while delayed first irrigation resulted in a reduction in seed germination percentage.

Plant height (cm)

The results regarding to plant height (cm) of maize as affected by the different irrigation scheduling are presented in Fig.2. The analysis of variance Fig 2 demonstrated significant (P≤0.05) impact of various irrigation intervals on plant height of maize. It is apparent from the results (Fig.2) that significantly maximum plant height (173 cm) on average was recorded in T2 treatment when the crop was given 1st irrigation at 20 days, 2nd 40 day and 3rd 60 days of sowing (T3); while the plant height slightly reduced (170.66 cm) in (T3). Maize crop recorded the minimum plant height (169.66 cm) in (T1) treatment. The differences in plant height between T^2(1st 20 days after sowing, 2nd 40 days after sowing and 3rd 60 days after sowing) and T1 (1^{st} 25 days After Sowing and 2^{nd} 55 days after sowing) were non-significant. We concluded that delayed 1^{st} irrigation up to 25 days after sowing impacted the plant height unfavorably.

Number of green leaf plant-^{1}

The results in respects to the number of green leaf plant-1 of maize as influenced by different irrigation scheduling are presented in Fig.3. The analysis of variance Fig 3 indicated significant (P≤0.05) influence of various irrigation scheduling on the amount of green leaf plant^{-1} of fodder maize. The results presented (Fig.3) that maximum number of green leaf plant^{-1} (12.08) on average was attained in crop given 1^{st} 20 days after sowing, 2^{nd} 40 days after sowing and 3rd 60 days of sowing (T^2), by the delay in the first irrigation the amount of green leaf plant^{-1} slightly decreased to (12.00) and (11.96) in T^3 and T^1 treatments, correspondingly.

Stem width

Results in regards to stem width of fodder maize as influenced by the different irrigation scheduling are demonstrated in Fig.4. The analysis of variance Fig 4 suggested significant (P≤0.05) effect of various irrigation scheduling on the stem width of fodder maize. The results (Fig.4) showed that maximum stem width (4.01 cm) on average was recorded in plants given 1st 20 days after sowing, 2nd 40 days after sowing and 3rd 60 days of sowing (T^2); while the lowest stem width (3.97 cm) was recorded in crop given (1^{st} 25 Days After Sowing and 2^{nd} 55 days after sowing). The LSD test suggested that statistically the differences in the stem width of maize between T^2 and T^1 were non-significant. This designates that $T^2$and T^1 irrigation scheduling resulted the best traits.

Yield kg. Ha^{-1}

The results in respects to yield Kg.ha^{-1} of maize as influenced by different irrigation scheduling are shown in Fig.5. The analysis of variance Fig 5 showed significant (P≤0.05) effect of various irrigation scheduling on the fodder yield Kg. h^{a-1} of maize. It is clear from the results (Fig.5) that highest fodder yield Kg.ha-1 (28545 kg) was produced by the crop given 1st 20 days after sowing, 2nd 40 days after sowing and 3rd 60 days of sowing (T^2); whereas the lowest fodder yield (27995 kg. ha^{-1}) was recorded in crop given 1st 25 Days after Sowing and 2nd 55 days after sowing (T^1). The LSD test showed that statistically the differences in yield Kg. ha^{-1} of maize between T^2 and T^1 were non-significant (P>0.05).

Discussion

Agriculture in Pakistan is limited to the time. Consequently, it is commanded to plan sound basis to improve Irrigation use efficiency and use of water may be safeguarded. The present study was carried out to examine the yield of maize under the influence of different irrigation scheduling. The results of the present study showed that the yield of maize varied significantly (P≤0.05) under the influence of different irrigation scheduling. T1=2 irrigations (1st 25 days After Sowing and 2nd 55 days after sowing) resulted in 80.17 % seed germination, 169.66.cm plant height, 11.96 numbers of green leaves plant-1, 3.99 cm stem width and 27995 kg ha-1 fodder yield. T2=3 irrigations 1st irrigation at 20 days, 2nd 40 day and 3rd 60 days of sowing resulted in 83.11% seed germination, 173.00 cm plant height, 12.08 numbers of green leaves plant-1, 4.01 cm stem width and 28545 kg ha-1fodder yield while treatment T3=4 irrigations (1st 20 DAS, 2nd 35 DAS, 3rd 50 and 4th 65 DAS). Produced 88.38% seed germination, 170.66 cm plant height, 12.00 numbers of green leaves plant-1, 3.98 cm stem width and 28160 kg ha-1 fodder yield; These results are in arrangement with those of Milani and Neishabouri (2001) who reported that irrigation interval may be decided in such a way to avoid excessive use of water to optimize the irrigation water requirement of maize. Abid Niaz et al., (2004) reported that 11 and 12 day irrigation proved to more effective than 13 days interval for achieving higher maize fodder yield. However, these suggestions could not be used for all the agriculture soils. In another investigation El-Tantawy et al. (2007) and Igbadun et al. (2008) concluded that crop water use efficiency and Irrigation water use efficiency (IWUE) were strongly influenced by the number of growth stages in which deficit irrigations were applied and how critical the growth stages were to moisture stress rather than the amount of irrigation water applied. While maximum water use efficiency was obtained under full irrigation, maximum was obtained in the deficit irrigation treatment at the vegetative growth stage, suggested that IWUE may be improved upon by practicing deficit irrigation at the vegetative growth stage of the maize crop. Hasil aslam et. al (2014) concluded that among irrigation Scheduling five irrigations (1st, 25 DAS and subsequent irrigations at 15 days interval), produced maximum all the growth and yield traits studied, particularly grain yield (6999.30 kg ha-1) as compared to four irrigations (1st30 DAS and subsequent irrigations at 20 days interval) and 3 irrigation (1st35 DAS and subsequent irrigations at 25 days interval). Among varieties SKD-1 gave superior performance, particularly grain yield (5818.80 kg ha-1) than TD-1 and Imdad. Hence SKD-1 x five irrigation interaction was found most suitable for obtaining a maximum grain yield (7444.70 kg ha-1) of wheat. Tariq and Usman (2009) found that there was a significant effect of irrigation depths on grain yield. Maqsood (2010) reported that six irrigations improved all the physiological traits over five and four irrigations in maize. Asim and Mohamed (2011) indicated that maximum plant population and field water use efficiency were obtained in the irrigation water amount of 50% ETc in both seasons. Also, 10 days irrigation interval gave the highest values of plant height, cob length, 100-seed weight, grain yield, Stover yield, and field water use efficiency. Khatun et al., (2012) concluded that the application of two irrigations would be better for growth and maximizing the yield of maize. Rusere et al., (2012) concluded that deficit irrigation results in a significant decline in silage maize yield and an increase in water use efficiency. Sana et. al (2014) concluded that interaction of five irrigations and wheat variety Sassui proved optimum for obtaining a maximum grain yield (7444.70 kg ha^{-1}).

Conclusion

It was concluded that maize yield did not demonstrate significant differences (P>0.05) once irrigated as per T^2 (1st irrigation after 20 days of sowing, 2nd after 35 days and 3rd after 50 days of sowing) and T^1 (1st 25 days after Sowing and 2nd 55 days after sowing) and the yield was significantly decreased when these treatments were compared with the rest of the irrigation regimes. So, T^2 and T^1 irrigation intervals where maximum effective to produce a higher yield in maize

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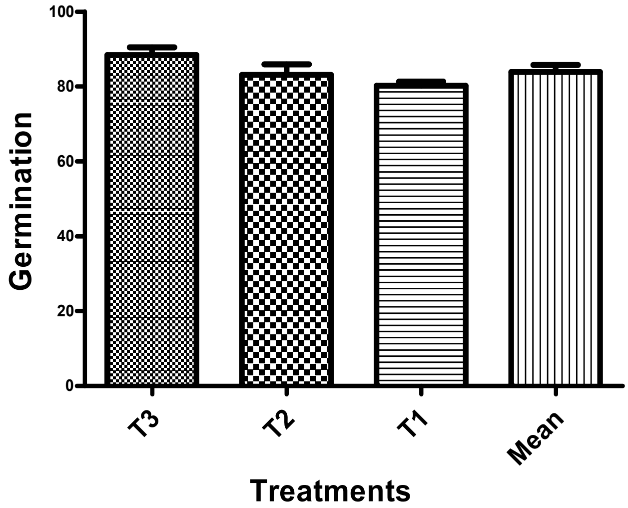

Fig 1. Germination (%) of maize as affected by different irrigation scheduling

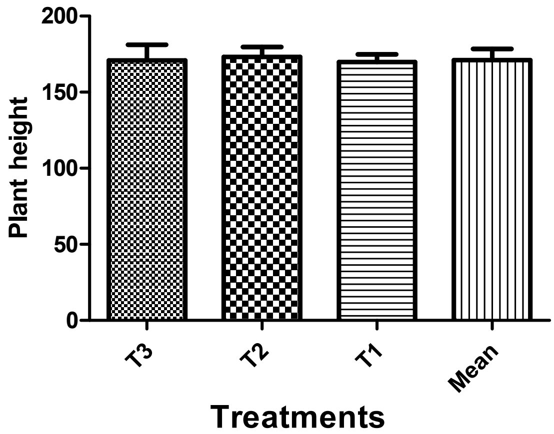

Fig 2 Plant height (cm) of maize as affected by different irrigation Schedulings

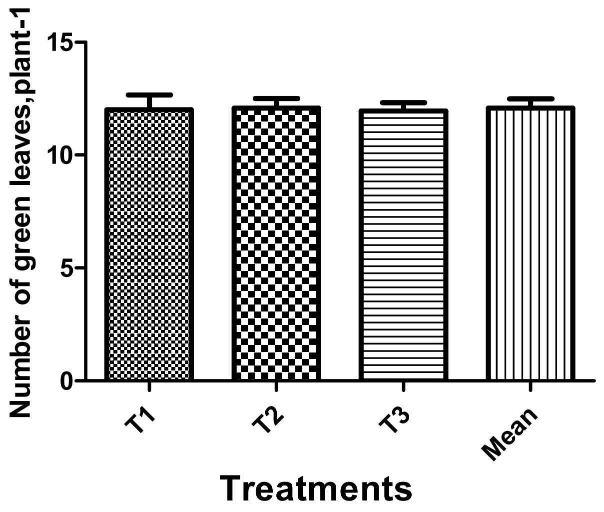

Fig 3. Number of green leaves, plant-1 of maize as affected by different irrigation schedulings

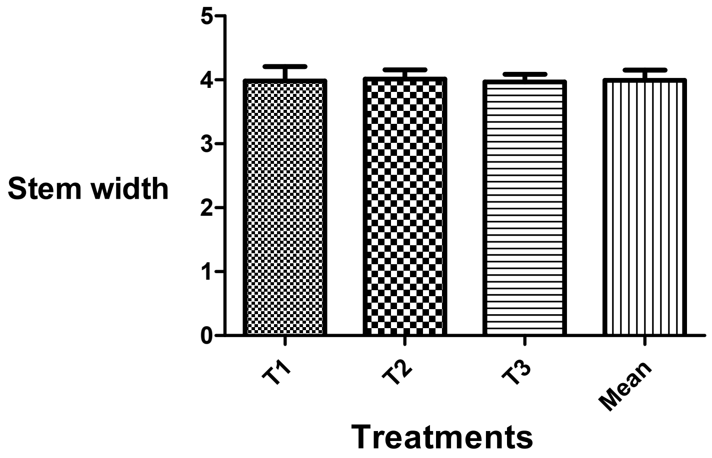

Fig 4 Stem width (cm) of maize as affected by different irrigation scheduling

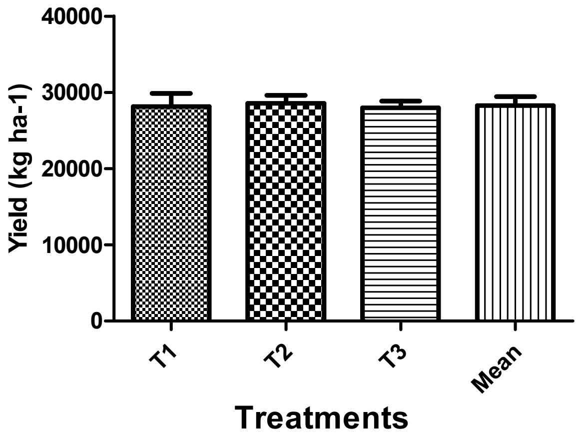

Fig 5. Yield (kg ha-1) of maize as affected by different irrigation schedulings

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