RESEARCH ARTICLE

IMPACT OF SUPPLEMENTAL IRRIGATION AND CROP RESIDUE MULCH ON BARNYARDMILLET (KUTHIRAIVALI– CO2) – ECHINOCHLOAESCULENTAIN ARID REGION

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Abstract: Field experiments were conducted to study the impact of supplemental irrigation and crop residue mulch on Barnyard millet (Kuthiraivali – CO2) cultivated in dryland areas of southern part of Tamil Nadu. The experimental was laid out in randomized block design with three treatments viz., T1 - Farmers practice (rainfed cultivation without supplemental), T2 - Supplemental irrigation twice through mini portable sprinkler and T3 - Supplemental irrigation twice through mini portable sprinkler and crop residue mulch 2.5 t/ha with three replications. The yield and economic analysis reveals that, during 2017-18 in barnyard millet (CO2), higher grain yield (1650 kg/ha), gross income (33000 Rs/ha) and B:C ratio (1.65) was recorded in supplemental irrigation twice through mini portable sprinkler and crop residue mulch 2.5 t/ha (T3) followed by supplemental irrigation twice through mini portable sprinkler (T2). The results of the study indicated that farm pond is an effective technology for harvesting andproviding water for supplemental irrigation.

Keywords: Dryland, Farm Pond, Barnyard Millet, Productivity, Supplemental Irrigation

INTRODUCTION

Millets are most important crop in semiarid tropics of Asia and Africa (especially inIndia, Nigeria and Niger), with 97.00 per centof production in developing countries. Barnyard millet (*Echinochloa* species) has become one of the most important minormillet crops in Asia, showing a firm upsurge in world production. It contains a rich source of protein, carbohydrates, fiber, and most notably, micronutrients like iron (Fe) and zinc (Zn) (Saleh *et al*., 2013) that are relatedto numerous health benefits (Ugare *et al*., 2014).

Rainwater harvesting for supplemental/lifesaving irrigation has become essential indryland farming for the benefit of farmers under ongoing changing rainfall situation and recurring droughts. Several studies were conducted to studythe effects of supplemental irrigation on crop yields under different growth environments and at different growth stages. Zhang *et al*. (2000) showed 70% increase inlentil grain yield on 1 or 2 applications of irrigation at flowering or pod-filling stage and also emphasized on the effectiveness of supplemental irrigation in dry season incomparison to the wet season. Pandey *et al*. (2013) established a novel approach to simulate supplemental irrigationand possible benefits of a rainwater harvesting system in rain-fedagricultural regions.

Farm ponds are efficient way to retain water for livestock, watering and provide supplemental irrigation in dryl and crops. Mahalleand Adhau (2014) presented that more number of protective irrigations (two to three) using harvested runoff water in dug out farm ponds resulted in increased productivity of cotton and gram crops around 47 to 55 per cent and 43 to 58 per cent, respectively. The effect of supplemental irrigation and crop residue mulch on little millet (CO4) cultivated in dryland areas of southern part of Tamil Naduand showed that farm pond is effective technology for harvesting and providing water for supplemental irrigation.

With this background, this paper presents the results of field experiments conducted to study the effect of supplemental irrigation and crop residue mulch on barnyard millet cultivated in dryland areas of southern part of Tamil Nadu.

MATERIALS AND METHODS

Field experiments were conducted for two crop seasons (2017-2019) at the Experimental Field of Agricultural Research Station, Tamil Nadu Agricultural University, Kovilpatti, Virudhunagar (Dt.), Tamil Nadu, India to study the effect of supplemental irrigation from farm pond and crop residue mulch on Barnyard millet (Kuthiraivali – CO2) crop. Kovilpatti is a semi-arid region with an annual rainfall of 704.7 mm.

Geographically it is situated at 9° 20’ North latitude and 78° 25’ east longitude at 90 MSL. The normal maximum and minimum temperature is 35º C and 22º C respectively. The predominant soil type is black soil (*Vertisol*).

The experiment was laid out in randomized block design with three treatments viz., T1 - Farmers practice (rainfed cultivation without supplemental), T2 - Supplemental irrigation twice through mini portable sprinkler and T3 - Supplemental irrigation

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twice through mini portable sprinkler and crop residue mulch 2.5 t/ha with three replications.

The supplemental irrigation was done with the rainwater harvested in a farm pond with a capacity of 800 m^3. The pond dimension is 20 x 20 x 2m and it is masonry lined. The catchment area under farm pond is around 3.0 ha. The runoff water collected from the catchment was 402 m^3. It was used for giving supplemental irrigation for barnyard millet crop.

The parameters like plant height (cm), number of panicles, number of tillers/plant, grain yield (kg/ha), soil moisture content before irrigation and after one supplemental irrigation (T2 & T3 only) were measured. The cost of cultivation (Rs / ha), gross income (Rs / ha), BC ratio and RWUE (kg /ha mm) were calculated.

RESULTS AND DISCUSSION

The weather, soil and plant parameters observed during the field experiments for two trial (2017-19) is presented. In 2017-18, the rainfall received during *rabi* season was 421.4 mm in 17 rainy days as against the normal rainfall of 398.6 mm in 21 rainy days. There was a 6 per cent increase in rainfall when compared to normal. The rainfall received during the months of October, November and December was 142.3, 130.7 and 148.4 mm against the normal of 192.2, 138.4 and 53.7 mm respectively. Similarly, in 2018-19, the rainfall received was 213.9 mm in 19 rainy days as against the normal rainfall and normal rainy days. There was a 46 per cent deficit in rainfall when compared to normal. The rainfall received during the months of October, November and December is 146.6, 53.5 and 13.8 mm against the normal of 195.2, 142.4 and 59.1 mm respectively.

Supplemental irrigation was given using mini portable sprinkler to a depth of 7.5 cm from the harvested rainwater stored in farm pond. The crop residue mulch 2.5 t/ha (T3) maintained the highest soil moisture content of 24.5 and 25.8 percent in 0-15 cm and 30 - 45 cm depth respectively followed by supplemental irrigation twice through mini portable sprinkler (T2). Fig. 2, 3 and 4 shows the effect of different treatments on plant growth. It is noted that compared to 2017-18 the number of panicles and tillers was less in during the year 2018-19 due the shortage of rainfall.

The yield and economic analysis reveals that, during 2017-18 in barnyard millet (CO2), higher grain yield (1650 kg/ha), gross income (33000 Rs/ha) and B:C ratio (1.65) was recorded in supplemental irrigation twice through mini portable sprinkler and crop residue mulch 2.5 t/ha (T3) followed by supplemental irrigation twice through mini portable sprinkler (T2). The supplemental irrigation twice through mini portable sprinkler and crop residue mulch 2.5 t/ha resulted in 38 per cent increased yield in barnyard millet. During 2018-19, barnyard millet (CO2) resulted in high grain yield (612 kg / ha) and gross income (12,240 Rs / ha) from the crop residue mulch against the control (498 kg/ha). The crop residue mulch 2.5 t/ha resulted in 22 per cent increased yield in barnyard millet over the control.

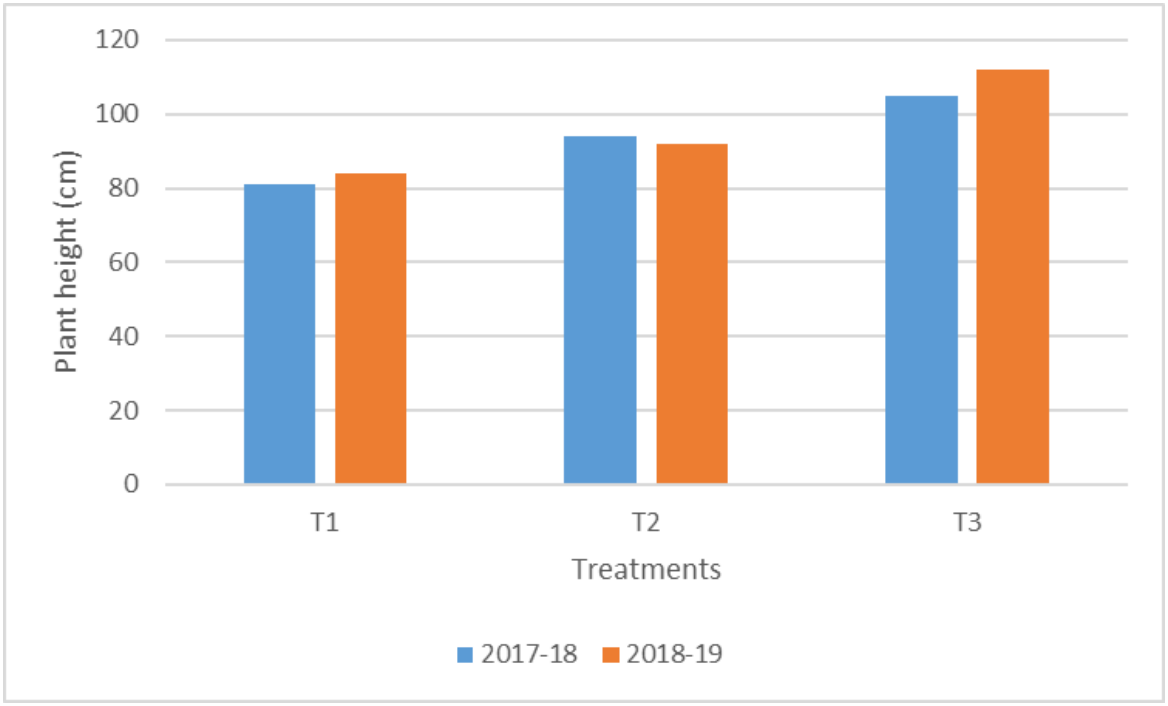

Fig. 2. Effect of different treatments on plant height

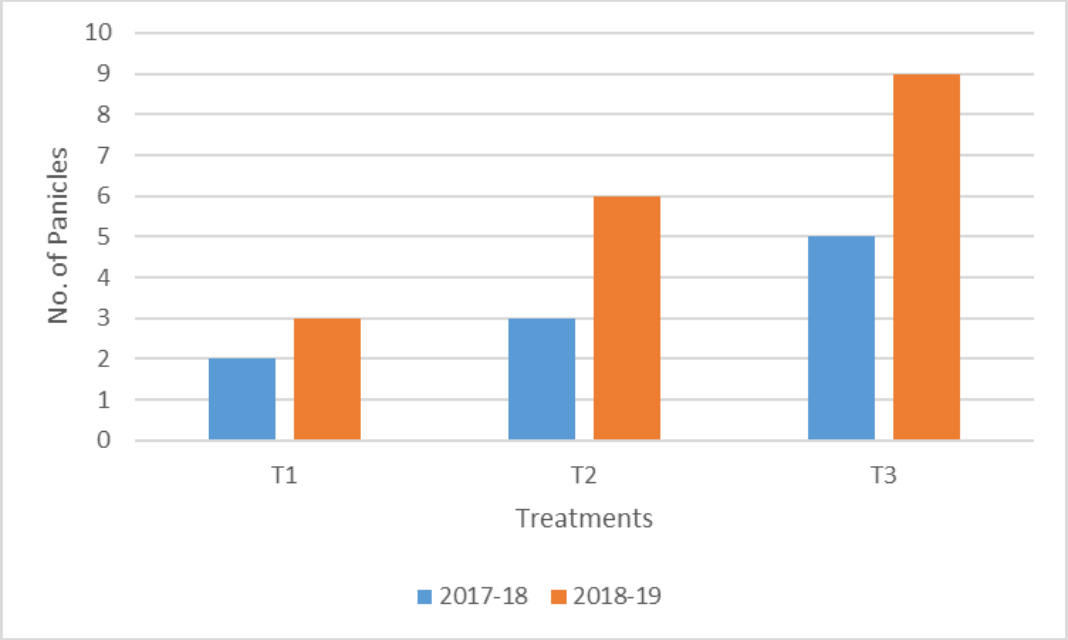

Fig. 3. Effect of different treatments on number of panicles

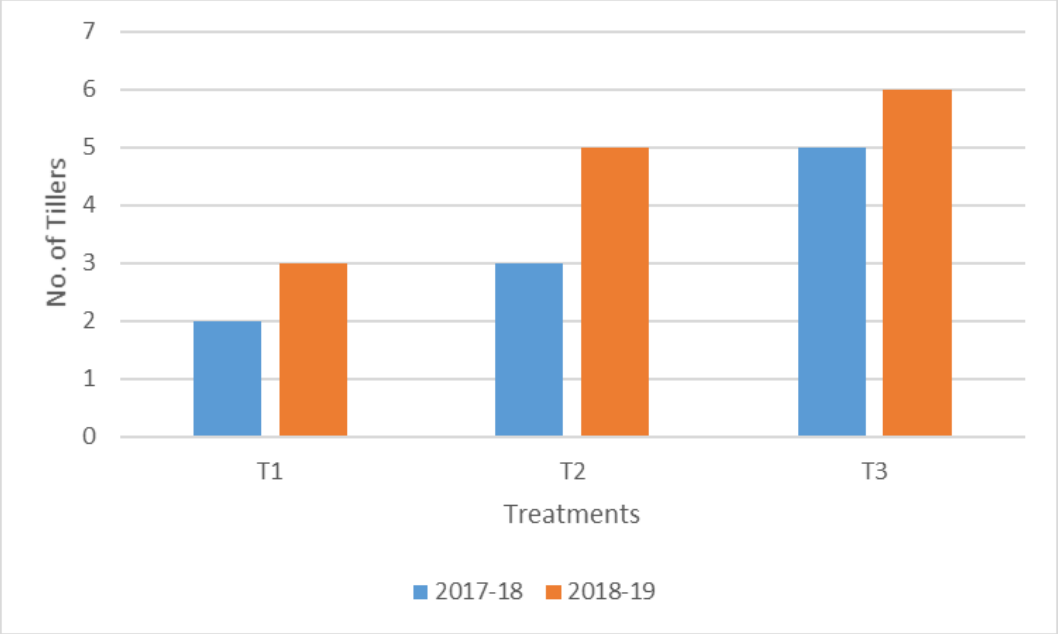

Fig. 4. Effect of different treatments on number of tillers

Table 2. Effect of treatment on yield and economics of Barnyard Millet

Year	2017-18			2018-19		
Treatments	T1	T2	T3	T1	T2	T3
Grain yield (kg/ha)	1193	1462	1650	498	534	612
Cost of cultivation(Rs/ha)	18200	18700	19950	18200	18200	19450
Gross income(Rs/ha)	23,860	29,240	33000	9,960	10,680	12,240
B.C ratio	1.31	1.56	1.65	0.55	0.59	0.63
RWUE	2.83	3.47	3.91	2.32	2.49	2.87

SUMMARY AND CONCLUSION

For future climate scenario, barnyard millet will be a promising crop for sustainable food and nutritional security. The supplemental/protective irrigation using harvested inrunoff water in dug out farm ponds increased the dry land productivity of barnyard millet crop. The results of the study showed that farm pond is an effective technology for harvesting andproviding water for supplemental irrigation.

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