International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(6): 2580-2583

Received: 09-09-2020
Accepted: 17-10-2020

CH Bhavya Sree
Advanced Post Graduate Centre, Lam, ANGRAU, Guntur, Andhra Pradesh, India

N Venkata Lakshmi
Advanced Post Graduate Centre, Lam, ANGRAU, Guntur, Andhra Pradesh, India

S Prathibha Sree
Advanced Post Graduate Centre, Lam, ANGRAU, Guntur, Andhra Pradesh, India

GV Lakshmi
Advanced Post Graduate Centre, Lam, ANGRAU, Guntur, Andhra Pradesh, India

K Chandrasekhar
Advanced Post Graduate Centre, Lam, ANGRAU, Guntur, Andhra Pradesh, India

Corresponding Author:
CH Bhavya Sree
Advanced Post Graduate Centre, Lam, ANGRAU, Guntur, Andhra Pradesh, India

Productivity of chickpea (*Cicer arietinum* L.) succeeding foxtailmillet (*Setaria italica* L.) as influenced by irrigation schedules and crop residue management

CH Bhavya Sree, N Venkata Lakshmi, S Prathibha Sree, GV Lakshmi and K Chandrasekhar

DOI: https://doi.org/10.22271/chemi.2020.v8.i6ak.11170

Abstract
Residual effect of *kharif* crop residue was studied in experiment conducted during *kharif,* 2018-19 and *rabi*, 2019-20 on clay soils of Advanced Post Graduate Centre, Lam, Guntur. Split-plot design was adopted where the main plots are four residue management practices *i.e.*, foxtailmillet residue incorporation with decomposer consortium followed by chickpea (M_1), foxtailmillet residue incorporation with FYM @ 5 t ha^{-1} followed by chickpea (M_2), foxtailmillet residue mulch followed by zerotill chickpea (M_3) and no residue incorporation (fallow during *kharif*) (M_4) and three irrigation schedules to *rabi* chickpea *i.e.*, no irrigation (I_1), one irrigation at 25 DAS (I_2) and two irrigations at 25 DAS and 55 DAS (I_3) as subplots which are replicated thrice. Foxtailmillet residue incorporation with decomposer consortium followed by chickpea (M_1) reported significantly highest growth, yield attributes, yield (seed and haulm) and harvest index on a par to foxtailmillet residue mulch followed by zerotill chickpea (M_3) but comparable with foxtailmillet residue incorporation with FYM @ 5 t ha^{-1} followed by chickpea (M_2). The seed yield reduction in no residue incorporation (fallow during *kharif*) (M_4) was 10.3% when compared to foxtailmillet residue incorporation with decomposer consortium followed by chickpea (M_1). Among irrigation schedules, two irrigations at 25 DAS and 55 DAS (I_3) registered the highest drymatter accumulation, plant height, yield attributes, seed yield and haulm yield compared to no irrigation (I_1).

Keywords: Foxtailmillet, Chickpea, crop residue incorporation, decomposer consortium, FYM, yield

Introduction
Millets are cultivated in an area of 21 lakh ha, production of 16 lakh tones and an average productivity of 762 kg ha^{-1} in Andhra Pradesh during 2017-18 (www.indiastat.com). They comprise of different types like finger millet, prosomillet, foxtailmillet, pearl millet including sorghum which are well considered as the crops of antiquity mainly known for their drought resistance, insects, pests and disease resistance. Millets are cultivated round the year, high yields are produced with limited volume of water in comparision to other cereals, drought resistant crops and require few external inputs. Due to these characters of millets, in Krishna zone of Andhra Pradesh, foxtailmillet possibly grown with rainfall during *kharif* and chickpea during *rabi* with the enduring soil moisture due to different residue management practices.
Foxtailmillet–Chickpea cropping system in place of leaving field fallow during *kharif,* chickpea or cotton or tobacco can improve the system productivity by enhancing agronomic efficiency, land use efficiency and WUE with limited inputs. The *kharif* crop residue can be managed efficiently by using it as mulch or by decomposing residue with decomposer consortium or residue can be incorporated. Therefore proper decomposition of plant residue by decomposer consortium enriched with microorganisms that accelerates the process of decomposition by releasing hormones and accelerates the plant growth. FYM has balanced nutrients acts as source of nutrients. Mulch improves the soil environment, stimulates microbial activity, enhances oxygen availability to roots, moderates soil temperature, increases soil porosity, increases nutrient availability, reduces evaporation, fertilizer leaching and soil compaction, controls weeds and increases plant growth, yield and quality. Chickpea

(*Cicer arietinium* L.) is a *rabi* pulse crop and largest produced food legume in South Asia. Among different pulses chickpea has highest area of 53.87 lakh ha, production of 45.99 lakh tones, productivity of 951 kg ha^{-1} in India during 2016-17 (www.indiastat.com). Soil moisture shows a crucial part in chickpea production determining the plant growth from seedling establishment to seed maturity. Surplus soil moisture owing to increased irrigation makes the plant to revert back to vegetative stage. Hence, irrigation scheduling at optimum time of crop growth is essential to improve water productivity.

Materials and Methods

A field trail was organized during *kharif*, 2018-19 and *rabi*, 2019-20 at Advanced Post Graduate Center, Lam, Guntur. The experimental location was geographically situated at 16° 36´ N latitude and 80° 43´ E longitude. It is about 8 km away from the Guntur town in the Krishna Agro-climatic Zone of Andhra Pradesh, India. Split plot design was adopted with four residue management treatments as main plots *i.e*., foxtailmillet residue incorporation with decomposer consortium followed by chickpea (M_1), foxtailmillet residue incorporation with FYM @ 5 t ha^{-1} followed by chickpea (M_2), foxtailmillet residue mulch followed by zerotill chickpea (M_3) and no residue incorporation (fallow during *kharif*) (M_4) and three irrigation schedules to *rabi* chickpea *i.e*., no irrigation (I_1), one irrigation at 25 DAS (I_2) and two irrigations at 25 DAS and 55 DAS (I_3) as subplots and replicated thrice. The soil of trail has pH of 8.2, organic carbon (0.59%) is medium and low in available nitrogen (180 kg ha^{-1}), medium in available phosphorous (18 kg ha^{-1}) and potassium (187 kg ha^{-1}) with clay texture. Dose of fertilizer recommended was @ 20 kg N ha^{-1} and 50 kg P_2O_5 ha^{-1} which was applied equally to all experimental plots. Entire dose of nitrogen in form urea, phosphorous in form of di ammonium phosphate was applied during last plough before sowing of chickpea.

Results and Discussion

Higher plant height at maturity was under foxtailmillet residue incorporation with decomposer consortium followed by chickpea (M_1) (38.7 cm) compared to foxtailmillet residue mulch followed by zerotill chickpea (M_3) (34.9 cm) and found on a par with foxtailmillet residue incorporation with FYM followed by chickpea (M_2) (37.2 cm). The results are in confirmity with those of Komal *et al*. (2018) [2]. Among irrigation schedules two irrigations at 25 DAS and 55 DAS (I_3) (38.1 cm) obtained significantly taller plants over no irrigation (35.7 cm) and at a par with irrigation at 25 DAS (I_2) (36.7 cm).

Significantly higher drymatter accumulation at maturity was noticed with foxtailmillet residue incorporation with decomposer consortium followed by chickpea (M_1) (5129 kg ha^{-1}) when compared with residue mulch followed by zerotill chickpea (M_3) (4028 kg ha^{-1}), on a par with foxtailmillet residue incorporation with FYM followed by chickpea (M_2) (4717 kg ha^{-1}), drymatter accumulation at M_2 (4717 kg ha^{-1}) and M_4 (4266 kg ha^{-1}) were comparable. These results are in accordance with those of Kumari *et al*. (2010) [3]. At maturity, the plot received two irrigations each at 25 DAS and 55 DAS (I_3) (4775 kg ha^{-1}) recoded higher drymatter accumulation which was found on a par with I_2 (4276 kg ha^{-1}). Enhanced dry matter accumulation with different irrigation schedules was also reported by Maneepitak *et al*. (2019) [4].

Foxtailmillet residue incorporation with decomposer consortium followed by chickpea (M_1) produced higher pods per plant, 100 seed weight compared to foxtailmillet residue mulch followed by zerotill chickpea (M_3) and no residue incorporation (fallow during *kharif*) (M_4) but on a par with foxtailmillet residue incorporation with FYM followed by chickpea (M_2), whereas, less pods per plant, test weight was registered when foxtailmillet residue mulch followed by zerotill chickpea (M_3). The pods per plant and 100 seed weight was significantly superior under the irrigation schedule tried at 25 and 55 DAS (I_3) over no irrigation (I_1), but found on a par with one irrigation at 25 DAS (I_2). These results are in agreement with Rajkumara *et al*. (2014) [6].

The highest seeds per pod were recorded at foxtailmillet residue incorporation with decomposer consortium followed by chickpea (M_1) and significantly superior to M_2, M_3 and M_4. The difference among the irrigation schedules for number of seeds per pod was non-significant. The results are in accordance with Daleshwar and Prasad (2017) [5]

The maximum seed yield, halum yield and harvest index were recorded with foxtailmillet residue incorporation with decomposer consortium followed by chickpea (M_1) and was significantly superior to M_3, M_4 and found on a par with foxtailmillet residue incorporation with FYM followed by chickpea (M_2); whereas, in case of halum yield and harvest index differences between M_3 and M_4 was found non-significant. The lowest yield of seed, haulm and harvest index were observed with foxtailmillet residue mulch followed by zerotill chickpea (M_3). This is due to wider C/N ratio of foxtailmillet residue, the fungal or bacterial ratio increased markedly while the decomposition proceeded, caused the temporary immobilization of inorganic N by microorganisms resulting in less N uptake, decreased nutrients availability in soil for plant growth and lowered the seed yield. Foxtailmillet residue incorporation with followed by chickpea (M_2) and irrigations at 25 DAS and 55 DAS (I_3) interaction effect resulted in higher seed yield but comparable with M_1I_3, M_1I_2, M_2I_2 and M_1I_1 plots. Among irrigation schedules, two irrigations each at 25 DAS and 55 DAS (I_3) indicated significantly greater halum yield and harvest index compared to I_1; whereas, in case of halum yield differences between I_2 and I_3 were not significant. The impact of irrigation schedules on seed yield was significant among all the treatments and highest seed yield was with two irrigations at 25 DAS and 55 DAS (I_3). These results are similar with those obtained by Singh *et al*. (2019) [8].

Table 1: Plant height (cm) of chickpea as influenced by foxtailmillet crop residue management and irrigation to *rabi* chickpea at harvest

Treatments	Plant height (cm)		
Foxtailmillet crop residue management (M)	30 DAS	60 DAS	Harvest
M_1 - Foxtailmillet residue incorporation with decomposer consortium followed by chickpea	28.2	35.5	38.7
M_2 - Foxtailmillet residue incorporation with FYM @ 5 t ha^{-1}followed by chickpea	26.7	35.2	37.2
M_3 - Foxtailmillet residue mulch followed by zero till Chickpea	22.6	29.9	34.9
M_4 - No residue incorporation (Fallow during *kharif*)	25.4	33.3	36.5
SEm±	0.73	0.64	0.61
CD (p=0.05)	2.5	2.2	2.1

CV%	8.5	5.7	4.9
Irrigation to *rabi* chickpea (I)			
I_1 - No irrigation	23.6	32.2	35.7
I_2 - One irrigation (40 mm) at 25 DAS	26.0	33.5	36.7
I_3 - Two irrigations (40 mm) at 25 DAS and 55 DAS	27.5	34.8	38.1
SEm±	0.56	0.59	0.54
CD (p=0.05)	1.6	1.2	1.6
CV%	7.5	6.0	5.0
Interaction (M×I)	N.S	N.S	N.S

Table 2: Drymatter accumulation (kg ha^{-1}) of chickpea as influenced by foxtailmillet crop residue management and irrigation to *rabi* chickpea at harvest

Treatments	**Drymatter accumulation (kg ha^{-1})**		
Foxtailmillet crop residue management (M)	30 DAS	60 DAS	Harvest
M_1 - Foxtailmillet residue incorporation with decomposer consortium followed by chickpea	136	1320	5129
M_2 - Foxtailmillet residue incorporation with FYM @ 5 t ha^{-1}followed by chickpea	126	1252	4717
M_3 - Foxtailmillet residue mulch followed by zero till Chickpea	110	1130	4028
M_4 - No residue incorporation (Fallow during *kharif*)	132	1233	4266
SEm±	3.72	24.32	131.42
CD (p=0.05)	12.8	84.1	454.8
CV%	8.8	5.9	8.6
Irrigation to *rabi* chickpea (I)			
I_1 - No irrigation	116	1165	4276
I_2 - One irrigation (40 mm) at 25 DAS	127	1247	4555
I_3 - Two irrigations (40 mm) at 25 DAS and 55 DAS	135	1288	4775
SEm±	2.65	12.81	112.31
CD (p=0.05)	7.9	38.4	336.7
CV%	7.2	3.6	8.5
Interaction (M×I)	N.S	N.S	N.S

Table 3: Pods per plant, Seeds per pod and 100 seed weight (g) of chickpea as influenced by foxtailmillet crop residue management and irrigation to *rabi* chickpea

Treatments	**Pods per plant**	**Seeds per pod**	**100 seed weight (g)**
Foxtailmillet crop residue management (M)			
M_1 - Foxtailmillet residue incorporation with decomposer consortium followed by chickpea	37.9	1.15	26.08
M_2 - Foxtailmillet residue incorporation with FYM @ 5 t ha^{-1}followed by chickpea	36.0	1.07	24.43
M_3 - Foxtailmillet residue mulch followed by zerotill chickpea	32.8	1.05	23.39
M_4 - No residue incorporation (Fallow during *kharif*)	35.0	1.06	23.56
SEm±	0.77	0.02	0.51
CD (p=0.05)	2.7	0.06	1.8
CV%	6.5	5.1	6.3
Irrigation to *rabi* chickpea (I)			
I_1 - No irrigation	34.1	1.03	23.04
I_2 - One irrigation (40 mm) at 25 DAS	35.9	1.10	24.79
I_3 - Two irrigations (40 mm) at 25 DAS and 55 DAS	36.4	1.12	25.27
SEm±	0.61	0.03	0.51
CD (p=0.05)	1.8	N.S	1.5
CV%	5.9	8.9	7.3
Interaction (M X I)	N.S	N.S	N.S

Table 4: Seed yield (kg ha^{-1}), Haulm yield (kg ha^{-1}) and Harvest index (%) of chickpea as influenced by foxtailmillet crop residue management and irrigation to *rabi* chickpea at harvest

Treatments	**Seed yield (kg ha^{-1})**	**Haulm yield (kg ha^{-1})**	**Harvest index(%)**
Foxtailmillet crop residue management (M)			
M_1 - Foxtailmillet residue incorporation with decomposer consortium followed by chickpea	2032	3593	36.6
M_2 - Foxtailmillet residue incorporation with FYM @ 5 t ha^{-1}followed by chickpea	2014	3488	36.5
M_3 - Foxtailmillet residue mulch followed by zerotill chickpea	1616	3056	34.5
M_4 - No residue incorporation (Fallow during *kharif*)	1821	3205	35.5
SEm±	39.78	107.90	0.43
CD (p=0.05)	137.7	373.4	1.5
CV%	6.4	9.7	3.6
Irrigation to *rabi* chickpea (I)			
I_1 - No irrigation	1761	3262	34.9
I_2 - One irrigation (40 mm) at 25 DAS	1873	3317	35.4

I_3 - Two irrigations (40 mm) at 25 DAS and 55 DAS	1978	3426	37.0
SEm±	23.93	49.6	0.45
CD (p=0.05)	71.7	148.6	1.3
CV%	4.4	5.1	4.3
Interaction (M X I)	S	N.S	N.S

Table 5: Interaction effect of foxtailmillet crop residue management and irrigation schedules on seed yield (kg ha^{-1}) of chickpea at harvest

Irrigation schedules (I)	Foxtailmillet crop residue management (M)				
	M_1	**M_2**	**M_3**	**M_4**	**Means**
I_1	2002	1910	1446	1684	1760
I_2	2028	2010	1563	1888	1872
I_3	2064	2121	1837	1891	1978
Mean	2032	2014	1615	1821	

	SEm +	CD (0.05)	CV (%)
Foxtailmillet crop residue management (M)	39.8	137.7	6.38
Irrigation levels (I)	23.9	71.8	4.4
Interaction			
(M x I)	47.86	143.5	
(I x M)	55.77	180.3	

Conclusion

Foxtailmillet residue incorporation with decomposer consortium followed by chickpea (M_1) reported significantly higher plant height and drymatter accumulation over foxtailmillet residue mulch followed by zerotill chickpea (M_3) but found comparable with foxtailmillet residue incorporation with FYM followed by chickpea (M_2). A significant increase in plant height and drymatter accumulation was observed with two irrigations at 25 DAS and 55 DAS (I_3) compared to no irrigation (I_1). This was due to availability of sufficient water at root zone for plant growth.

The data recorded on yield attributes such as number of pods per plant, seeds per pod and 100 seed weight revealed that foxtailmillet residue incorporation with decomposer consortium followed by chickpea (M_1) recorded significantly higher values of yield attributes in chickpea. The lowest values were recorded with foxtailmillet residue mulch followed by zerotill chickpea (M_3). Among irrigation schedules two irrigations at 25 DAS and 55 DAS (I_3) recorded the higher number of pods per plant and 100 seed weight compared to no irrigation (I_1) but statistically on a par with one irrigation at 25 DAS (I_2). However, influence of different irrigation schedules on grains per pod were found non-significant.

Seed yield, haulm yield and harvest index of chickpea were recorded maximum under foxtailmillet residue incorporation with decomposer consortium followed by chickpea (M_1) compared to foxtailmillet residue mulch followed by zerotill chickpea (M_3) and no residue incorporation (fallow during *kharif*) (M_4) but on par with foxtailmillet residue incorporation with FYM followed by chickpea (M_2), where as foxtailmillet residue mulch followed by zerotill chickpea (M_3) recorded significantly lower values compared to M_1, M_2 and M_4. The interaction effect of foxtailmillet residue incorporation with FYM followed by chickpea (M_2) and irrigations at 25 DAS and 55 DAS (I_3) resulted in significantly higher seed yield which was comparable with M_1I_3, M_1I_2, M_2I_2 and M_1I_1. Among irrigation schedules two irrigations at 25 DAS and 55 DAS (I_3) recorded higher seed yield, haulm yield and harvest index of chickpea compared to I_1.

References

1. https://www.indiastat.com/agriculture-data/2/agricultural-area-land-use/152/area-under-food-crops/448934/stats.aspx
2. Komal D, Bhakar SR, Lakhawat SS, Chhipa BG, Singh M. Response of chickpea (*Cicer arietinum* L.) productivity under different irrigation frequencies and mulching. Int. J. Curr. Microbiol. App. Sci, 2018;7(9):3638-3642.
3. Kumari CR, Reddy DS, Vineetha U. Dry matter production and nutrient uptake of succeeding groundnut (*Arachis hypogea* L.) as effected by cumulative residual effect of crop residue incorporation and nitrogen management practices. Legume Research-An International Journal 2010;33(1):33-37.
4. Maneepitak S, Ullah H, Paothong K, Kachenchart B, Datta A, Shrestha RP. Effect of water and rice straw management practices on yield and water productivity of irrigated lowland rice in the central plain of Thailand. Agricultural Water Management 2019;211:89-97.
5. Rajak D, Prasad P. Effect of mulches on growth and yield of chickpea (*Cicer arietinum* L.). Int. J. Curr. Microbiol. App. Sci 2017;6(7):3893-3897.
6. Rajkumara S, Gundlur SS, Neelakanth JK, Ashoka P. Impact of irrigation and crop residue management on maize (*Zea mays* L.)-chickpea (*Cicer arietinum* L.) sequence under no tillage conditions. Indian Journal of Agricultural Sciences 2014;84(1):43-48.
7. Sarkar S, Sarkar A. Role of irrigation and mulch in chickpea (*Cicer arietinum* L.) growth, productivity and moisture extraction pattern in alluvial zone of West Bengal, India. Legume Research-An International Journal 2019;42(1):77-83.
8. Singh R, Singh VK, Singh YP, Sarker A. Effect of residue management on yield and economics of pearlmillet based cropping systems under rainfed conditions. Current Journal of Applied Science and Technology 2019;37(6):1-4.