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RESEARCH ARTICLE

GROWTH, YIELD ATTRIBUTES AND YIELD OF BOTTLE GOURD (*LAGENARIA SICERARIA*) AS INFLUENCED BY WOOL WASTE AND INORGANIC FERTILIZERS IN ARID REGION

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Abstract: A field experiment was conducted during *kharif* season 2018 at research farm of Agricultural Research Station, SKRAU, Bikaner, to study the effect of wool waste and inorganic fertilizers on growth, yield attributes and yield of bottle gourd (*Lagenaria siceraria*) in loamy sand soil. The experiment was laid out in randomized block design with ten treatments and three replications. The treatments viz., T_1- Control , T_2- Recommended dose of fertilizer, T_3 - wool waste@ 20 t ha^{-1}, T_4 - RDF +wool waste @ 20 t ha^{-1}, T_5 - RDF +wool waste @ 20 t ha^{-1} + 1 per cent $FeSO_4$, T_6- RDF +wool waste @ 20 t ha^{-1}+ 1 per cent $FeSO_4$ + 0.5 per cent $ZnSO_4$, T_7- STCR recommendation fertilizer dose, T_8- STCR recommendation + wool waste @ 20 t ha^{-1}+ 1 per cent $FeSO_4$, T_9- STCR recommendation + wool waste @ 20 t ha^{-1}+ 1 per cent $FeSO_4$ and T_{10} -STCR recommendation + wool waste @ 20 t ha^{-1}+ 1 per cent $FeSO_4$+ 0.5 per cent $ZnSO_4$. Application of wool waste and inorganic fertilizers had significant influence on growth parameters, yield attributes and yield of bottle gourd as compared to control. The results revealed that application of RDF + wool waste @ 20 t ha^{-1} + 1 per cent $FeSO_4$ significantly improved the number of branches plant-1, number of fruit vine-1, weight of fruit, diameter of fruit and average length of fruit in comparison to control. Significantly higher vine length at 30, 60 and 90 DAS, days to appearance of first flower and yield were also observed with RDF + wool waste @ 20 t ha^{-1} + 1 per cent $FeSO_4$.

Keywords: Bottle gourd, Wool waste, Fertilizers, Growth, Yield attributes

INTRODUCTION

Wool is an important textile fiber in the world. It is used for wool manufacturing, clothes and carpets. Globally, India ranks seventh in wool production (1.8%), especially coarse wool with a productivity of 0.600 kg sheep^{-1} year^{-1}. Rajasthan specially the Bikaner district is one of the highest sheep and wool producing areas in the country. There are about 163 woolen mills in Bikaner, manufacturing 1.5 lakh kg of Carpet Wool per day and releasing a huge quantity of wool waste, approximately 4-5 % of Mainly the wool waste is generated from 'Opener Section' of woolen industry. In wool processing industries, nearly 10–15% wool is considered as waste obtained during processing and discarded or dumped as such on ground (Sharma *et al*., 2019). Waste wool is light, voluminous and proteinaceous in nature. Wool waste of sheep's are mostly deposited in landfills and nutrients contain can no longer be exploited. More environmentally friendly alteration is to use it as manures. Applied hydrolyzed wool also improved seed emergence and plant growth (Nustorova *et al*., 2006). The productivity could be sustained through integrated use of organic and inorganic fertilizers.

Bottle gourd is one of the important cucurbits commonly grown in both rainy and summer season in various parts of India. The fresh fruit has light green smooth skin and white flesh. They come in a variety of shapes: they can be huge and round, small and bottle shaped or slim and serpentine, some times more than a meter long. The edible portion of fruit contains 96.3 per cent moisture, 2.9 per cent carbohydrates, 0.2 per cent protein, 0.1 per cent fat, 0.5 per cent mineral matter and 11 mg of vitamin C per 100 g fresh weight. The fruit is also known to have a good source of essential amino acids such as leucine, phenyl alanine, theonine, cystine, valine, aspartic acid and proline, along with fair amount of

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vitamin B complex, especially thiamine, riboflavin and niacin. India being the second largest producer of vegetable in the world, after China, shares about 15 per cent of the world output of vegetables from about 3 per cent of total cropped area in the country. Therefore, keeping these points in view present study was planned to study the effect of wool waste and inorganic fertilizers on growth, yield attributes and yield of bottle gourd (*Lagenaria siceraria*) in loamy sand soil.

MATERIALS AND METHODS

The experiment was conducted at the research farm of ARS, SKRAU, Beechwal, Bikaner during *kharif* season of 2018. It is situated at 28˚ 10' N latitude, 73˚ 18' E longitude and 223.88 meters above mean sea level in Agro-climatic zone Ic (Hyper arid partially irrigated western plain) of Rajasthan. The zone is characterized with extremes of hot. The temperature ranged between 9.9^{o}C and 39.5^{o}C during crop growing season. The minimum and maximum relative humidity of the locality fluctuates in between 19.7 to 89.1 per cent. The bright sunshine hours in *Kharif* season of 2018 was recorded from 4.0 to 9.7 Hrs throughout the experiment. The total rainfall was 68.4 mm with 4 rainy days from 23 July 2018 to 2 December 2018. The soil of the experimental field was characterized as Loamy sand in texture, having pH (8.65), EC (0.10 dSm^{-1}), organic carbon (0.15 per cent) , available nitrogen (125 kg ha^{-1}), available P2O5 (26.2 kg ha^{-1}), available potassium (169 kg ha^{-1}), available sulphur (23.9 kg ha^{-1}), zinc (0.86 ppm), iron (5.69 ppm), bulk density (1.55 Mg m^{-3}) and Hydraulic conductivity (12.31 cm hr^{-1}). The experiment comprised ten treatments viz., T_1- Control , T_2- Recommended dose of fertilizer, T_3 - wool waste@ 20 t ha^{-1}, T_4 - RDF +wool waste @ 20 t ha^{-1}, T_5 - RDF +wool waste @ 20 t ha^{-1} + 1 per cent $FeSO_4$, T_6- RDF +wool waste @ 20 t ha^{-1}+ 1 per cent $FeSO_4$ + 0.5 per cent $ZnSO_4$, T_7- STCR recommendation fertilizer dose, T_8- STCR recommendation + wool waste @ 20 t ha^{-1}+ 1 per cent $FeSO_4$, T_9- STCR recommendation + wool waste @ 20 t ha^{-1}+ 1 per cent $FeSO_4$ and T_{10} -STCR recommendation + wool waste @ 20 t ha^{-1}+ 1 per cent $FeSO_4$+ 0.5 per cent $ZnSO_4$. The experiment was laid out in randomized block design with three replications. Wool waste @ 20 t ha-1 (28 kg plot-1) was applied as per plot treatment combination before one month of sowing. Nitrogen @ 100 kg ha-1 was applied. Fertilizers were applied as per the RDF and STCR recommendation. According to the STCR recommendation, different treatment have different fertilizer dose like:

For Nitrogen = 1.1 T* - 0.92 N – 0.82 O**N

For Phosphorus = 0.54T* - 1.32 P_2O_5 – 1.07** P_2O_5

For potassium = 0.52 T* – 0.25 K_2O – 0.55 O** K_2O

*target yield **organic

Sowing of bottle gourd was done on 24th August 2018. The distance between row to row as well as plant to plant was kept at 1.0 m and 1.25 m, respectively. Thus, Nine plants were accommodated in each plot. The first irrigation was done after sowing of bottle gourd, later on three days interval. At the time of fruiting, the irrigation was given at three to four days interval depending upon soil moisture conditions using the drip irrigation method. Nitrogen was supplied in the form of urea. Half dose of nitrogen was applied at the time of field preparation, and remaining does at 60 days after sowing. As per the treatments, phosphorus @ 40 kg ha^{-1} was applied through DAP (46 % P_2O_5) as a basal dose. Potassium was supplied @ 40 kg ha^{-1} through MOP (60% K_2O). 150 g ferrous sulphate was dissolved in 15 liter water, and 3-4 g of citric acid added to avoid the burning effect on the leaf. A small amount of gum was also added as a surfactant. The foliar spray was done at 45 days after sowing. 75 g zinc sulphate was dissolved in 15 liter water, and 3-4 g of citric acid added to avoid the burning effect on the leaf. A small amount of gum was also added as a surfactant. The foliar spray was done at 46 days after sowing. Five plants were selected and tag at random for observation to record the different parameters at consecutive stages of growth, Number of branches, Vine length (m), Days taken to first flower appearance, Number of fruit $vine^{-1}$, Fruit length (cm), Fruit weight (g), Fruit diameter (cm) and yield (q ha^{-1}). Experimental data recorded in various observations were statistically analyzed with the help of Fisher's analysis of variance technique (Fisher, 1950). The critical difference (CD) for the treatment comparisons were worked out wherever the variance ratio (F test) was found significant at 5% level of significance.

RESULTS AND DISCUSSION

Effect of wool waste and inorganic fertilizers on growth parameters of bottle gourd: Wool waste and inorganic fertilizers were significantly improved the number of branches $plant^{-1}$ and vine length of bottle gourd (Table 1). Application of RDF +wool waste @ 20 t ha^{-1} + 1 per cent $FeSO_4$ + 0.5 per cent $ZnSO_4$ recorded maximum number of branches $plant^{-1}$(5) which was significantly higher than control (2.67). Vine length was found to increase at all the growth stages (Table 1). It was observed that application of RDF + wool waste @ 20 t ha^{-1} + 1 per cent $FeSO_4$ + 0.5 per cent $ZnSO_4$ has resulted in significantly higher vine length with the value of 3.67, 4.67 and 6.67 m at 30, 60 and 90 DAS over control. Application of wool waste as a nutrient source for field crops may be an excellent soil amendment for improving yield and quality of produce. All the growth parameters and yield contributing characters were also improved with waste wool. Several researchers were also reported

that substrate amendment with waste wool as fertilizer source contributed to increasing yield attributing characters and yield of plant [Das *et al*., (2015), Baghel *et al*., (2017), Nagar *et al*., (2017)].

Effect of wool waste and inorganic fertilizers on flowering characters of bottle gourd: Bottle gourd plant required minimum days (Table 1**)** for first female flower initiation (61.00 days) in comparison to control (84.00 days) when the soil was fertilized with RDF +wool waste @ 20 t ha^{-1} + 1 per cent $FeSO_4$ + 0.5 per cent $ZnSO_4$. Similar kind of result has been revealed in a study on integrated nutrient management in cucumber by Bindyia *et al*., (2006) where they observed that combined application of vermicompost (2 t/ha) + ½ RD of NPK (50:30:30 Kg/ ha) + Azotobacter and PSB each at 5 kg/ha showed earliness and took lesser number of days for 50% flowering. Mulani *et al*., (2007) observed that in bitter gourd minimum days for 50% flowering and significantly lowest node number on which first female flower appeared were recorded with the application of neem cake (25% N) + poultry manure (75% N) + vermicompost + sulphate of potash + package (combination of neem cake) + Trichoderma viridae + Azotobacter + Azospirillum + PSB + neem seed kernal extract. The present trend of days to appearance of first female flower is in a good agreement with the above mentioned findings.

Effect of wool waste and inorganic fertilizers on yield attributing characters and yield of bottle gourd: Significant influences on yield attributing characters and yield were accomplished by wool waste and inorganic fertilizers (Table 2). Number of fruit $vine^{-1}$(17.00), weight of fruit (961g), length of fruit (34.00 cm), diameter of fruit (17.33 cm) and yield (404 q ha^{-1}) were recorded as the maximum in the treatment which received RDF +wool waste @ 20 t ha^{-1} + 1 per cent $FeSO_4$ + 0.5 per cent $ZnSO_4$ viz., T_6. According to Anitha et al, 2003, the highest yield of pickling melon was obtained with the application of 10 t vermicompost + NPK @ 70: 25: 25 kg/ha. Experimental results of Anjanappa *et al*. (2012) revealed that enhanced yield parameters of cucumber (cv. Hassan Local) like, number of fruits per vine and maximum fruit weight were recorded with the application of FYM + Azotobacter + Phosphobacteria + Trichoderma. Mulani *et al*. (2007) reported that in bitter gourd a synergistic interaction between organic manure and bio fertilizers resulted in enhanced fruit length and fruit girth which ultimately increased average fruit weight. The results of the present experiment are in line with the above mentioned findings.

Table 1. Number of branches $plant^{-1}$ and vine length (m) at 30, 60 and 90 DAS as influenced by wool waste and inorganic fertilizers

Treatments	Number of branches $plant^{-1}$	Vine length (m) 30 DAS	Vine length (m) 60 DAS	Vine length (m) 90 DAS
T_1	2.67	0.98	2.00	3.67
T_2	3.67	1.67	3.00	4.33
T_3	4.00	2.00	3.33	5.00
T_4	4.00	1.67	3.33	4.67
T_5	4.33	1.67	4.00	5.00
T_6	5.00	3.67	4.67	6.67
T_7	3.67	2.33	3.67	4.67
T_8	4.00	2.67	3.33	5.67
T_9	4.00	2.00	3.00	5.00
T_{10}	4.67	2.33	4.33	5.67
S.Em.±	0.24	0.21	0.26	0.23
C.D. (P=0.05)	0.72	0.61	0.76	0.69

Table 2. Effect of wool waste and inorganic fertilizers on yield attributes and yields of bottle gourd

Treatments	Days to appearance of first female flower	Number of fruit $vine^{-1}$	Average weight of fruit (g $fruit^{-1}$)	Average length of fruit (cm)	Fruit Diameter (cm)	Yield (q ha^{-1})
T_1	84.00	7.00	492	19.00	11.33	170
T_2	79.00	11.67	600	24.67	14.00	271
T_3	79.00	15.00	743	29.67	16.00	295
T_4	75.67	15.67	794	29.33	16.00	351
T_5	64.67	14.67	822	30.33	17.00	386
T_6	61.00	17.00	961	34.00	17.33	404
T_7	78.00	13.33	694	26.33	14.67	280
T_8	77.33	13.67	750	27.33	15.67	341

T_9	70.33	15.00	789	31.67	16.00	378
T_{10}	67.33	16.00	920	31.33	16.67	385
S.Em.±	0.54	0.40	31	0.46	0.31	7
C.D. (P=0.05)	1.62	1.18	91	1.36	0.94	21

CONCLUSION

Based on the results of one year experimentation, it may be inferred that application of application of RDF +wool waste @ 20 t ha^{-1} + 1 per cent $FeSO_4$ + 0.5 per cent $ZnSO_4$ significantly increased the Growth, yield and yield attributing characters of bottle gourd in loamy sand soils of western Rajasthan.

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