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Research Article

Sorghum (*Sorghum bicolor* L.) cultivation in ravines affected area with organic farming for nutritional grains production in Uttar Pradesh

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Abstract

The experiment was undertaken during two consecutive years in rainy season of 2009-10 and 2010-11 under ravines affected area of pilot village of *Kanharpura*, Jalaun, U.P. The experiment was conducted under **"Farmers Participatory Action Research Project on Water/Water Harvesting Scheme"** funded by **Central Water Commission, New Delhi**. The main objective was to utilize the reclaimed ravinous affected land in production of *Coarse Nutritive* grains of sorghum for poor families of degraded land of Bundelkhand (U.P.). The pilot soil was parwa (sandy loam), having poor status of plant nutrients. Three treatments i.e. compost 200 qt + mustard cake 100 kg/ha, compost 200 qt. + neem cake 100 kg/ha and compost 200 qt. + caster cake 100 kg/ha were tested under natural farming. The sorghum was planted at spacing of 45 cm x 15 cm in the end of first fortnight of July and harvested after 100 DAP on 24 October during two experimental years. Cultivar CSH-14 was selected for ravines affected area and planted. The application of compost 200 qt. + mustard cake 100 kg/ha gave highest grains yield by 29.50 qt/ha, closely followed by compost 200 qt + neem cake 100 kg/ha (29.10 q/ha). Compost 200 qt. + cater cake 100 kg/ha yielded lowest yield by 28.95 q/ha. The maximum yield of dry fodder was recorded under compost 200 qt + mustard cake 100 kg/ha by 95.00 q/ha. The application of compost 200 qt + neem cake 100 kg/ha and compost 200 qt + caster cake 100 kg/ha produced at par fodder yield by 93.70 q/ha and 93.00 q/ha, respectively. The growth and yield traits were commensurable to the grain yield of sorghum.

Keywords: *Coarse grains, International Millet Year, Nutritive grains, Organic farming, Sorghum crop.*

Introduction

After green revolution the area under rice-wheat cropping system increased and in millet crops or coarse grain crops, especially in sorghum it reduced. The 40% share of millet crops is reduced, and at present this sharing is only 10%. It is well known fact that the millet crops have good nutritional value. With this factor, the year 2023 has been declared the **"International Millet Year"** by the Indian Government. Millets are the power house of nutrition. The Ministry of Agriculture, Govt. of India has declared the nutritional grains during the year of 2018. Generally, sorghum, bajra, maura (ragi), cheena, kodo, shavan, gundali, kutaki, kutu and chaulai are some important crops included in the millet group. The nutritional value of this group is 65-70% carbohydrate, 7-12% protein, 2-5% fats and 15-20% dietary fiber (Anonymous, 2022).

The northern tract of alluvial soil and Bundelkhand region of Uttar Pradesh, having loamy sand, sandy loam, sandy clay loam and light loam of riverine tract and raker, parwa, kawar and mixed kawar of Bundelkhand zone of Uttar Pradesh are famous for sorghum cultivation. In early, 1980,s sorghum was grown in U.P. on 0.68 million ha with total production of 0.41 million tones. Since then both area and production have shown a

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steady decline due to various reasons. In 2019-2020 the sorghum area was reduced to 0.17 million ha with a total production of 0.23 mt (Anonymous, 2021). Effect to arrest this decline in area and production did not succeed due to various factors including economic reasons. A strong need was felt to develop a suitable organic system of production of sorghum grains for consumers. Because sorghum grains have moisture 11.88%, protein 10.42%, mineral 1.76%, calcium 0.027%, phosphorus 0.282% and iron 6.18% which is similar to the wheat (Nezamuddin and Sinha, 1968). Sorghum is grown with limited water resources and usually without major inputs by a multitude of marginal and sub marginal farmers in Uttar Pradesh. They are often referred to as "Coarse grain" or poor people's crop owing to its important of teemed poor people. The farmers do not have an assured market of their surplus production. Improvement in production, availability, storage, utilization and consumption of these food crops will significantly contribute to the household food security and nutrition of the inhabitants of these areas. Sorghum is predominantly grown for grain as well as fodder in different part of Uttar Pradesh and is one of widely grown forage crop with good nutritive value for animals. Sorghum grain is eaten by human beings in Uttar Pradesh by preparing *Chapattis*. Therefore, with the aforementioned points a flexible plan was made on grains production through organic manure application and carried out ravines affected area is the subject matter of this manuscript.

Material and Methods

The field study was undertaken during two consecutive years in rainy season of 2009-10 and 2010-11 under ravines affected area of village *Kanharpura* of distract Jalaun, Uttar Pradesh under **"Farmers Participatory Action Research Project on Water/Water Harvesting Scheme"** funded by **Central Water Commission, New Delhi**. The main objective was to utilize the reclaimed ravines affected land in production of coarse nutritive grains of sorghum for poor families of degraded land of Bundelkhand (U.P.). The pilot area soil was parwa, having pH 8.0, organic carbon 0.21, total nitrogen 0.02%, available P_2O_5 8.30 kg/ha and available K_2O 170 kg/ha. The pH was determined by Electrometric glass electrode method (Piper, 1950), while organic carbon was determined by Colorimetric method (Datta *et al.,* 1962). Total nitrogen was analyzed by Kjendahl's method as discussed by Piper (1950). The available P_2O_5 and K_2O were determined by Olsen's method (Olsen *et al.*, 1954) and Flame photometric method (Singh, 1971), respectively. Three treatments i.e. compost 200 qt + mustard cake 100 kg/ha, compost 200 qt. + neem cake 100 kg/ha and compost 200 qt. + caster cake 100 kg/ha were tested under natural farming. The sorghum was planted at spacing of 45 cm in rows and 15 cm distance maintained plant to plant in rows. The sorghum was planted in the end of first fortnight of July and harvested after 100 DAP on 24 October during two experimental years. Since, the hybrid cultivar CSH 14 was planted, required 80 kg N + 40 kg P_2O_5 + 20 kg K_2O/ha for grain production, which was given by compost @ 200 q/ha. The mustard, neem and caster cakes were also used in combination of compost to fulfill the plant nutrients and protection from the seasonal insects. The conservation agronomical practices were followed in raising of sorghum. The protective irrigations were given as and when required. The yield data was recorded and summarized.

Result and Discussion

The pooled data of growth, yield traits and grain yields of sorghum are given in Table-1 and discussed here under appropriate heads.

Table.1. Effect of different treatments on growth, yield traits and grain yield of sorghum. (Pooled data of two years)

Sl. No.	Treatment	Plant height (cm)	Functioning leaves at 60 DAS	Stem girth (cm)	Weight of panicle (g)	Weight of grains/ panicle (g)	1000-grain weight (g)	Grain yield (q/ha)	Dry fodder yield (q/ha)	Harvest index (%)
1.	Compost 200 Qt + mustard cake 100 kg/ha	180.10	9.22	7.51	37.46	26.96	23.42	29.50	95.00	23.69
2.	Compost 200 Qt + neem cake 100 kg/ha	179.80	9.19	7.48	37.39	26.90	23.39	29.10	93.70	23.70
3.	Compost 200 Qt + caster cake 100 kg/ha	178.94	9.17	7.46	37.31	26.81	23.35	28.95	93.00	23.74

Sorghum at compost 200 Qt + Mustard cake 100 kg/ha

Sorghum at compost 200 Qt + Neem cake 100 kg/ha

Growth parameters: The data recorded on plant height have been summarized in Table-1. It is clear from the results that sowing of crop with compost 200 Qt + mustard cake 100 kg/ha brought out maximum height under pooled results of two years (180.10cm). Application of compost 200 Qt + caster cake 100 kg/ha displayed minimum height by 178.94cm. The application of compost 200 Qt +neem cake @ 100 kg/ha showed plant height by 179.80 cm. The variability in plant height was due to variation in available percentage of nitrogen in the cakes.

Perusal of data make it clear that functioning leaves of maximum growth stage of 60 days after planting and stem girth were not influenced by different treatments.

Yield contributing traits: Slightly higher panicle weight was measured under treatment of compost 200 Qt + mustard cake 100 kg/ha by 37.46 g. Other two tested treatments i.e., compost 200 Qt + neem cake 100 kg/ha and compost 200 Qt + caster cake 100 kg/ha displayed panicle weight at par by 37.39 g and 37.31 g, respectively. Similar trends were also recorded in weight of grains/panicle and 1000-grain weight in pooled results of two years of experimentation.

Grain yield (q/ha): It is clear from the pooled results given in Table-1 that the application of compost 200 Qt + mustard cake 100 kg/ha gave highest yield by 29.50 q/ha, closely followed by compost 200 Qt + neem cake 100 kg/ha (29.10 q/ha). Compost 200 Qt + caster cake 100 kg/ha yielded lowest yield by 28.95 q/ha. The variation in nitrogen percentage, which was available in cakes responsible for higher productivity of sorghum grains.

Dry fodder yield (q/ha): The maximum yield of dry fodder was weighed under application of compost 200 Qt + mustard cake 100 kg/ha by 95.00 q/ha. The application of compost 200 Qt+ neem cake 100 kg/ha and compost 200 Qt + caster cake 100 kg/ha produced at par dry fodder yield. The mustard cake has higher percentage of nitrogen which was available about 70% to the sorghum plants, responsible for higher productivity of dry fodder over the other two cakes combination treatments.

Harvest index: The similar harvest index (%) was calculated under different treatments. The similar grain yield ratio in total biomass production under different treatments was responsible for at par harvest index. It indicates that the different treatments have similar potential for grain production.

Conclusion and Recommendation

The application of compost 200 Qt + mustard cake 100 kg/ha registered highest grains and dry fodder yield of sorghum, therefore, farm families residing in ravines affected area may be advocated for combined application of aforementioned dose of compost and mustard cake.

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