

Original Research Article

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Productivity and Quality Dynamics of *Parching* Sorghum Genotypes as Influenced by Nitrogen Management through Vermicompost during *Rabi* Season

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ABSTRACT

An experiment was conducted on “Productivity and quality dynamics of *parching* sorghum genotypes as influenced by nitrogen management through vermicompost during *rabi* season” of 2018-19. The results revealed that among the *parching* sorghum genotypes, Gulbhendi Local-1 showed significantly higher growth attributes viz., plant height, dry matter plant⁻¹ and stem diameter as compared to genotype Phule madhur at harvest. However, the *parching* sorghum genotype Phule madhur showed significantly more number of leaves, leaf area plant⁻¹ and leaf : stem ratio over genotype Gulbhendi Local-1. With respects to yield attributes, the *parching* sorghum genotype Phule madhur recorded higher green *hurda* yield over the genotype Gulbhendi Local-1 and found significantly superior of the *parching* sorghum genotype Gulbhendi Local-1. However, the genotype Gulbhendi Local-1 recorded maximum green fodder yield and found significantly superior over the genotype Phule Madhur. The highest benefit: cost ratio was observed in Phule Madhur as compared to Gulbhendi Local-1 genotype. With regards to nitrogen management at harvest, application of 125% RDN ha⁻¹ through vermicompost recorded superior growth as well as yield attributes along with optimum B:C ratio and was found significantly superior over 100 percent RDN ha⁻¹ through vermicompost, 50 per cent RDN ha⁻¹ through vermicompost and control, respectively. The experimental consequences revealed that with respects to quality analysis of grain the *parching* sorghum genotype Phule Madhur found superior over Gulbhendi Local-1. Similarly, the results revealed that in respect of proximate analysis, the fodder from Gulbhendi Local-1 found superior over Phule madhur with respect to crude protein, crude fibre, Ether Extract and total ash. However, the genotype Phule Madhur found better in producing Nitrogen free extract. In respect of quality and proximate analysis, application of 125% RDN through vermicompost also proved significantly superior over other nitrogen management treatments.

Keywords

Parching sorghum,
Genotypes,
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Management

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Introduction

Sorghum has good nutritional composition similar to rice and wheat in some aspects. The grains contain high fiber and non-starchy polysaccharides and starch with some unique characteristics. There is a considerable variation in sorghum for levels of proteins, lysine, lipids, carbohydrates, fiber, calcium, phosphorus, iron, thiamine and niacin (Shobha *et al.*, 2008; Chavan *et al.*, 2009). Protein quality and essential amino acid profile of sorghum is better than many of the cereals and millets. Sorghum in general is rich source of fiber and B-complex vitamins (Gopalan *et al.*, 2000 and Patil *et al.*, 2010).

Sorghum is rich in fiber and minerals, apart from having a sufficient quantity of carbohydrates (72%), proteins (11.6%) and fat (1.9%). Starch is the major constituent of the grain. The protein in sorghum contains albumin globulin (15%), prolamin (26%) and glutelin (44%). Sorghum does not contain gluten, hence the dough does not have stickiness, to roll with the chapatti roller. The flour from sorghum is gluten free and is a safe energy source for people allergic to gluten. The minimal amounts of flavanols and phytic acid are present in white sorghum (Chavan and Patil, 2010).

The tender jowar grains in Marathi is called as “*hurda*” and in Gujarati it is called as ‘Ponk’. Basically, *hurda* is roasted food product prepared from sweet sorghum on coal in mud pits which gives it an earthy taste. This freshly roasted *hurda* is then eaten with an accompaniment of various types of chutneys made up of sesame, groundnut, dry coconut, garlic and red chillies. Additives like jaggery, revdi, lime and miri shev make the taste more pleasant. According to a recent Guardian article American chefs say that sweet sorghum is the next ‘wonder grain’. They extoll its health benefits, its versatility in

cooking (among other things, it pops like corn) and its ecofriendliness due to being exceptionally drought-tolerant. (ICRISAT, 2013).

Hurda is referred to tender jowar available during late winter it is the main staple grain of rural Maharashtra. The period in early January when jowar grain is juicy and very tender which is roasted over cakes of dried cow dung then roasted *hurda* hold in bare palms, vigorous rubbing to separate roasted *hurda* from the chaff. *Hurda* could be another reason to do a winter trip to Maharashtra and head out into its fields where enterprising farmers now advertise *hurda* or *ponk* parties. Far from America’s food trends, this is where sweet sorghum has always been celebrated at its seasonal best. The consumption of *hurda* has more importance and popular in India since ancient times because of its unique sweet taste. It is generally prepared by roasting over cakes of dried cow dung. Besides, sweet taste *hurda* has some nutritional properties, like good source of dietary fibers, proteins, minerals and carbohydrates. This can be a gluten free diet option for celiac patients. It helps in not only weight loss but also acts as a coolant for the body. *Hurda* is commonly eaten with the hull, which retains the majority of the nutrients and very high in fiber and iron, with a fairly high protein level and also a good source of phosphorus and thiamine. *Hurda* is rich in antioxidants and all sorghum varieties are gluten-free, an attractive alternative for wheat allergy sufferers.

The tender sweet sorghum (*hurda*) is known for its delicious taste. There is a need to popularize sorghum food as *hurda* with its high minerals and fiber content and with slow starch digestibility makes an ideal food for diabetic and obese population in the urban as well as rural society. Increasing urban population demand the *hurda* has increased

many folds. This would be opportunity for farmers to fulfil the demand for supplying *hurda* and improve their farm earning. It was therefore felt to develop and identify the genotype for tender sweet sorghum (*hurda*) purpose which will give benefit to the farmers and consumers too. Now a day's agro-tourism business is increasing in the rural areas and in the contest of supplying sorghum *hurda* as a niche product get the more profit to the farmers and producers (Taylor *et al.*, 2006).

Methodology

Field study investigation entitled, "Productivity and quality dynamics of *parching* sorghum genotypes as influenced by nitrogen management through vermicompost during *rabi* season" was conducted at Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during *rabi* season of 2018-19. The soil of the experiment plot was clay loam in texture with pH 8.3 indicating alkaline reaction. The experiment was laid out in factorial randomized block design and three replications. The treatments comprises of two *parching* sorghum genotypes viz., G₁-Phule Madhur, G₂-Gulbhendi Local-1 and four nitrogen management treatments viz., 125% RDN ha⁻¹ through vermicompost (100 kg N ha⁻¹), 100% RDN ha⁻¹ through vermicompost (80 kg N ha⁻¹), 50% RDN ha⁻¹ vermicompost (40kg N ha⁻¹) and control. The climate of the area is semi-arid characterized. Maximum temperature varies from 26.5 to 35.3 °C and minimum temperature from 9.4 to 19.3 °C during the growing period. Average relative humidity in the *rabi* season was ranged from 49 to 83% in morning hours and from 20 to 36% in evening hours. Rate of evaporation was higher during 2nd to 7th MW than normal. It was lower during 49th and 1st MW than normal. Whereas, the rainfall has received 47th meteorological weeks. The soil was clay loam in texture, moderate in organic carbon,

available nitrogen, and available phosphorus and fairly rich in available potash. The nitrogen management was carried out through vermicompost and applied to soil before sowing as per treatments. The quantity of vermicompost 1335, 2670 and 3337 kg ha⁻¹ was used to supply 50%, 100% and 125% RDN, respectively. The control treatment comprised of no nutrient management.

Results and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads:

Production traits

The data pertaining to production traits as influenced by different treatments are in Table 1.

Effect of genotypes

The data pertaining to growth traits in Table 1 revealed that, the *parching* sorghum genotype Gulbhendi Local-1 showed significantly higher growth attributes such as plant height, dry matter plant⁻¹ and stem diameter and was found significantly superior over genotype Phule Madhur at harvest. However, the *parching* sorghum genotype Phule Madhur recorded significantly higher growth attributes such as number of leaves plant⁻¹, leaf area plant⁻¹ and leaf:stem ratio plant⁻¹ found superior as compared to genotype Gulbhendi Local-1. This might be due to the vigorous growth habitats and adaptability of genotypes where it grown. Significantly higher green *hurda* yield (kgha⁻¹) of *parching* sorghum recorded by the genotype Phule Madhur and found significantly superior over the as compared to genotype Gulbhendi Local-1. The green fodder yield (qha⁻¹) of *parching* sorghum recorded maximum in the

genotype Gulbhendi Local-1 and found significantly superior over the Phule Madhur genotype. This might be due to the growth habitats and adaptability of genotypes where it grown. The results are in conformity with Shinde *et al.*, (2016). The benefit: cost ratio was highest in the Phule Madhur genotype (3.91:1) over the genotype Gulbhendi Local-1. The higher partitioning of dry matter towards grain yield in genotype Phule Madhur. The genotype Phule Madhur was good in threshability which results into maximum *hurda* yield.

Effect of Nitrogen management

The data pertaining to growth traits in Table 1 revealed that, application of 125% RDN ha⁻¹ through vermicompost recorded sophisticated plant height, number of leaves plant⁻¹, leaf area plant⁻¹, leaf:stem ratio plant⁻¹, dry matter plant⁻¹ and stem diameter plant⁻¹ found significantly superior over control and comparable with 100% RDN ha⁻¹ through vermicompost, 50% RDN ha⁻¹ through vermicompost at harvest, respectively.

The results conformity with Ahmad *et al.*, (2007), Arbad *et al.*, (2008), Satpal *et al.*, (2015), Singh *et al.*, (2016), Meena *et al.*, (2017). The data pertaining to yield traits in Table 1 revealed that the treatment of nitrogen management with application of 125% RDN

Rating Scale

Aroma	1	Good	2	Fair	3	No aroma
Taste	1	Very sweet	2	Medium sweet	3	Slightly sweet
Threshability	1	Free	1.5	Medium	2	Hard

Effect of genotype

Both the genotypes Phule Madhur and Gulbhendi Local-1 was found good in aroma along with very sweet taste. However, with

ha⁻¹ though vermicompost recorded sophisticated green *hurda* yield (kg ha⁻¹) was found significantly superior over other treatments i.e. application of 100% RDN ha⁻¹ through vermicompost, 50% RDN ha⁻¹ through vermicompost and control at harvest, respectively. As, the treatment of nitrogen management with application of 125% RDN ha⁻¹ though vermicompost recorded sophisticated green fodder yield (q ha⁻¹) was found significantly superior over control and comparable with 100% RDN ha⁻¹ through vermicompost, 50% RDN ha⁻¹ through vermicompost at harvest, respectively. The results are in conformity with Patidar (2004). With regards to the Benefit : Cost ratio was found more in control treatments over other nitrogen management treatments with application of 100% RDN ha⁻¹ through vermicompost, 50% RDN ha⁻¹ through vermicompost and control , respectively. As the Benefit: Cost ratio was found significantly more in control treatments due to there was no expence regarding to vermicompost but quality was imperior.

Organoleptic parameters

The data pertaining to organoleptic parameters viz., aroma, taste and threshability as influenced by different treatments are calculated by the rating scale given below and are presented in Table 2.

reputes to threshability, genotype Phule Madhur found free than the genotype Gulbhendi Local-1. The results are in conformity with Shide *et al.*, (2016) and Darekar *et al.*, (2019).

Table.1 Mean Production traits as affected by nitrogen management in *parching* sorghum

Treatments	Height (cm)	Number of leaves plant ⁻¹	Leaf area plant ⁻¹ (dm ²)	Leaf : stem ratio	Dry matter accumulation (g plant ⁻¹)	Stem Girth (cm)	Days to soft dough stage	Green <i>Hurda</i> Yield (kg/ha)	Fodder Yield (t/ha)	B:C ratio
Factor A-Genotypes										
G₁-Phule Madhur	181.5	10.58	36.766	2.46	147	1.6167	97	3978	41.14	3.91
G₂-Gulbhendi Local-1	224.3	9.367	35.999	2.23	158	1.815	96.3	3107	58.55	3.74
SE(m)_±	1.257	0.096	0.078	0.08	0.26	0.0199	0.19	64.8	0.84	-
CD at 5%	3.813	0.29	0.2367	0.23	0.8	0.0603	0.56	197	2.549	-
Factor B- Nitrogen management										
N₁-125% RDN ha⁻¹ as Vermicompost	215	10.27	37.235	2.7	157	1.8533	98.3	4601	52.54	3.39
N₂-100% RDN ha⁻¹ as Vermicompost	207	10.18	37.033	2.45	154	1.74	97	3843	51.1	3.25
N₃-50% RDN ha⁻¹ as Vermicompost	199	10.05	35.888	2.18	152	1.6833	96.2	3092	49.09	3.73
N₄-Control	190.4	9.4	35.373	2.05	149	1.5867	95.2	2634	46.64	4.92
SE(m)_±	1.778	0.135	0.1104	0.11	0.37	0.0281	0.26	91.6	1.188	-
CD at 5%	5.393	0.41	0.3348	0.33	1.13	0.0853	0.79	278	3.604	-

Table.2 Organoleptic parameter regarding parching sorghum as influenced by various treatments

Treatment	Aroma	Taste	Threshability
G ₁ N ₁	1	1	1
G ₁ N ₂	1	1	1
G ₁ N ₃	1	1	1
G ₁ N ₄	1	1	1
G ₂ N ₁	1	1	1.5
G ₂ N ₂	1	1	1.5
G ₂ N ₃	1	1	1.5
G ₂ N ₄	1	1	1.5

Effect of nitrogen management

Aroma and taste were not influenced by the different nitrogen management treatment. Threshability was not influenced by the different nitrogen management treatment. The results are in conformity with Darekar *et al.*, (2019).

Quality and proximate analysis

The data pertaining to Quality and Proximate analysis as influenced by different treatments are presented in Table 3.

Effect of genotypes

The data pertaining to quality analysis(in *hurda* grain) in Table 3 revealed that, the *parching* sorghum genotype Phule Madhur showed significantly higher quality attributes such as reducing sugar (%), non-reducing sugar(%), total sugar (%) along with protein content(%) and was found significantly superior over genotype Gulbhendi Local-1. However, with repute towards the proximate analysis (in green fodder) revealed that, the *parching* sorghum genotype Gulbhendi Local-1 recorded more value of crude protein %, crude fibre %, ether extract % as well as

total ash % and found significantly superior over the *parching* sorghum genotype Phule Madhur. The results are with conformity of Darekar *et al.*, (2019).

Effect of nitrogen management

The data pertaining to quality analysis (in *hurda* grain) in Table 3 revealed that, the treatment with application of 125% RDN ha⁻¹ through vermicompost significantly higher quality attributes such as reducing sugar (%), non-reducing sugar(%), total sugar (%) along with protein content(%) and was found significantly superior over other treatments of nitrogen management viz. with application of 100% RDN ha⁻¹ through vermicompost, 50% RDN ha⁻¹ as vermicompost and control, respectively.

However, with repute towards the proximate analysis (in green fodder) revealed that, significantly higher crude protein, ether extract, total ash and nitrogen free extract was observed with application of 125% RDN ha⁻¹ through vermicompost as compared to application of 100% RDN ha⁻¹ through vermicompost, 50% RDN ha⁻¹ as vermicompost and control, respectively.

Table.3 Mean quality (in green hurda) and proximate (in green fodder) analysis affected by nitrogen management in *parching* sorghum

Treatments	Reducing sugar (%)	Non-reducing sugar (%)	Total sugar (%)	Protein (%)	Crude Protein%	Crude Fibre%	Ether Extract %	Total Ash %	NFE %
Factor A-Genotypes									
G₁-Phule Madhur	1.01	11.76	12.77	11.26	8.11	29.03	1.62	8.12	53.12
G₂-Gulbhendi Local-1	0.8	8.11	8.19	10.34	8.29	29.14	1.71	8.21	52.70
SE(m)_±	0.03	0.20	0.20	0.06	0.03	0.19	0.02	0.01	0.12
CD at 5%	0.09	0.60	0.61	0.19	0.10	0.56	0.08	0.04	0.35
Factor B- Nitrogen management									
N₁-125% RDN ha⁻¹ as Vermicompost	1.31	11.12	12.44	11.75	8.33	28.16	1.71	8.21	53.60
N₂-100% RDN ha⁻¹ as Vermicompost	1.00	9.30	10.31	10.84	8.24	28.51	1.68	8.17	53.50
N₃-50% RDN ha⁻¹ as Vermicompost	1.14	10.89	12.03	10.50	8.16	29.48	1.66	8.15	52.57
N₄- Control	0.84	8.82	9.66	10.31	8.07	30.18	1.63	8.12	51.99
SE(m)_±	0.04	0.28	0.29	0.09	0.05	0.26	0.04	0.02	0.16
CD at 5%	0.12	0.85	0.87	0.27	0.14	0.80	0.11	0.05	0.50

However, control treatment recorded significantly higher crude fibre over the other nitrogen management treatments. This might be due to Increase in crude protein content of fodder sorghum may definitely, be due to the fact that nitrogen often plays a great role in the synthesis of protein. Increase in crude protein content (%) of fodder sorghum with increase in nitrogen levels have been reported by Muhammad *et. al.* (2011), Dhar *et al.*, (2003) and Bhilare *et.al.* (2002) which confirms the results obtained in present investigation.

The parching sorghum genotype Gulbhendi Local-1 was found superior in growth attributes, green fodder yield along with proximate analysis over the genotype Phule Madhur. The parching sorghum genotype Phule Madhur was found superior in yield attributes as well as quality and organoleptic parameter over the genotype Gulbhendi Local-1. The nitrogen management treatment with application of 125% RDN ha⁻¹ through vermicompost found superior in all growth, yield and quality attributes.

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