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Research Article

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Evaluation of Pigeon pea (*Cajanus cajan*) Varieties for Biomass Yield and Quality Parameters under Irrigation in three districts of South Omo, South-Western Ethiopia

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10 to 27.46% (Hunegnaw and Birehan, 2016; Denbela *et al*, 2018; Denbela *et al*., 2020). It was reported that the dry matter yields

sench and Nyagatom districts of South Omo. Dassench district is situated at a geographical location of 5°14’0”N Latitude, 36°44’ 01”E Longitude with an elevation range of 350 to 900 meter above sea level with an average temperatures ranging from 25 to 40°C. The annual rainfall is ranging from 350 to 600mm having a bimodal rainfall type with erratic distribution and soil type is Alluvial. According to the population projections for 2016/17 based on the population and housing census conducted in 2007 (CSA, 2008), the Dassench district has a total human population of 70, 133 and whereas, the population of livestock are estimated to be 1, 014, 403 cattle, 753, 568 sheep, 1, 013971 goats, 23, 412 Poultry and 17, 228 donkeys. The Hamer district is also among the districts found in South Omo with an estimate the total population of 79, 419 (CSA, 2010). The population is composed of three ethnic groups of Ham-

bele from Nyagatom district were selected for a participatory on-farm evaluation trial. One APREG in each Kebele with 25 household (20 males and 5 females) was established with active involvements of district pastoral office expertise, Keble development agents and local leaders. After establishment of APREGs, training was organized for all APREGs members and agricultural extension workers on forage agronomic parameters and forage production techniques, irrigation water management schemes.

Experimental Design and Treatments

The four Pigeon pea varieties namely DZ-16555, DZ-00420, DZBS and Tsegabe were collected from Debire Zeit Agricultural Research

Center, whereas, the pigeon pea variety which used as local check was purchased from the local market. The tested pigeon pea vari-

yields in kg/m to t/ha. To determine the fresh weight of leaf to stem ratio, samples were categorized into leaf and stem first and then the weights of each component was measured separately. The samples were oven dried for 24 hours at a temperature of 105°C and separately weighed to estimate the proportions of these parts. Accordingly, the Leaf to Stem Ratio (LTSR) was estimated based on the dry matter of each component.

Quality Parameter Analysis

The laboratory analysis was done at Debre Birhan Agricultural Research Center, Ethiopia. Three forage sample of each variety was allowed to be oven dried set at a temperature of 65°C for 48 hours

and ground to pass through a 1mm sieve screen for chemical analysis (AOAC, 1990). Dry mater (DM), crude protein (CP) and ash were

variety but it was similar (p>0.05) to DZ-00420, Tsegabe and local check varieties. Pertaining to branches per plant (BPP), result from this study was declared that significantly higher (p<0.05) branches per plant were observed for DZ-16555 and local check varieties than DZ-16575, DZ-00420 and Tsegabe varieties. The higher biomass yield for DZ-16555 variety over other varieties from this study is due to high genetic potential of variety. The previous studied reports were showed that the wider range of biomass yield difference observed between forage species could be attributed due to differences in genetic potential of variety to adapt to given agro-ecologies (Usman *et al*., 2018). The biomass yield obtained from this study for DZ-16555 and Tsegabe higher than previously

reported values of (6.47t ha^{-1}) and (5.42t ha^{-1}) by Abuye *et al.* (2019) and 13.92-21.84 t ha^{-1} Denbela *et al.*(2020) from Ethiopia,
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branches per plant at Hamer district than Dassench and Nyagatom districts is due to suitable temperature and favorable soil param-

Nyagatom districts in 2019 cropping year.

Effect of Location on Biomass yield, Plant Height, Branches per Plant and LTSR

The effects of location on biomass yield, plant height, branches per plant and LTSR are presented in Table 2. The results from this study shown that the higher ($p<0.05$) biomass yield, longer plant height and more branches per plant were obtained from Hamer district than Dassench, Nyagatom districts and however, these parameters were similar ($p>0.05$) for Dassench and Nyagatom districts. The result from this study for LTSR revealed that the higher ($p<0.05$) leaf to stem ratio was observed for Dassench district than Hamer and Nyagatom districts. The higher biomass yield, plant height,

Effect of Location by Variety on Biomass yield, Plant height, Branches per Plant and LTSR

The effect of location by variety on biomass yield, plant height, branches per plant and leaf to stem ratio are presented in Table 3. The result for location by variety revealed that the higher ($p<0.05$) biomass yield was obtained from Hmer location than Dassench and Nyagatom locations for all pigeon varieties, but it was similar ($p>0.05$) for Dassech and Nyagatom locations. Conversely, longer ($p<0.05$) plant height was also observed at Hamer location than Dassench and Nyagatom locations for all varieties except Tseagabe variety which is significantly (p<0.05) shorter plant height in Nyagatom location than Dassench location. Moreover, more (p<0.05)

	Hamer	27.18^{b}	2.88^{a}	26b^{cde}	0.70^{e}
	Nyagatom	7.56^{cd}	1.76^{de}	18.67^{efg}	1.32^{bc}
DZ-16555	Dassench	15.36^{c}	1.75^{de}	23.33^{cdef}	2.14^{a}
	Hamer	37.20^{a}	2.74^{a}	39.67a	0.73^{de}
	Nyagatom	11.26^{cd}	1.70e	21.33^{cdef}	1.64^{abc}
SEM	-	4.88	0.21	5.28	0.26
LSD	-	10.01	0.43	10.82	0.53

Table 3: *Effect of location by variety on biomass yield, plant height, branches per plant and LTSR at irrigated lowland of Dassench, Hamer and Nyagatom districts in 2019 cropping year.*

Key note: (Means with the same letters (a, b, c d, e, f, g) across column for biomass yield, Plant height, Branches per Plant and LTSR =Leaf

CP value for pigeon pea DZ-16555 was comparable to the value of 26.41% reported by Mekonnen *et al.*(2016), but it was higher than values reported by Netsanet and Yonatan (2015) and Denbela et al.(2018) for Tsegabe, DZ-00420 and DZ-16575 varieties. The animals are needed diets which have high quality protein to acquire desired production. The ruminant animals will be transformed the crude protein in feeds into ammonia by microbial digestion and this ammonia is used as source of nitrogen for rumen microbes to synthesis microbial protein which will be used by host animal (Pazla et al., 2018). Generally, the crude protein contents from present study (1991g/kg– 271g/kg, DM) for all varieties were higher than the minimum required crude protein levels (70-80g/kg, DM) for normal microbial digestion take place in rumen of ruminant herbi- [illegible]

[illegible] ies except local check variety can be classified as medium quality forages class.

Variety	DM%	Ash (g kg,DM^{-1})	CP (gkg^{-1}, DM)	NDF (gkg^{-1}, DM)	ADF (gkg^{-1}, DM)
Tsegbe	89.85	88.1	230^{b}	572.6	433.80
DZ-00420	90.33	69.4	215.5^{bc}	572.1	431.50
DZ-16575	90.83	70.8	227.8^{b}	553.1	423.80
DZ-16555	77.13	95.2	271.8^{a}	530.9	407.20
Local-check	90.33	79.3	199.1^{c}	608.1	427.70
SEM	8.51	17.3	11.8	50.60	39.70
LSD	17.88	36.5	2.48	10.64	83.80

[illegible] nutrients which will be used by the plant is known to increase leaf area and rate of photosynthesis and as a consequence, the CP content of subsequently the increased with lower fibers contents.

Conclusion

The higher biomass yield was obtained for the DZ-16555 variety, while lower biomass yield was for local pigeon pea variety. Conversely, DZ-16555 variety gave the higher crude protein and lower NDF and ADF, while pigeon pea local variety gave the lower crude protein and higher NDF and ADF. Pertaining to location effect, the higher biomass yield was obtained from Hamer location, whereas the lower biomass yield was obtained from Nyagatom location. On the other hand, the result for location by variety showed that the forage biomass yield, plant height, tillers per plant and leaf to stem

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