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Adaptability study of cowpea (*Vigna unguiculata)* genotypes for their agronomic performance and nutritive value in Adola district of East Guji zone of Oromia.

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ABSTRACT

The study was conducted to identify adaptable, high biomass and seed yield of Cowpea genotypes. Three Cowpea genotypes Bole, 6786 and 2351 were tested in a randomized complete block design (RCBD) with three replications. The result revealed that days to 50% flowering, days to seed maturity, plant height and seed yield was significantly (P<0.05) different among treatments. Among the tested genotypes late matured was obtained from genotype 6786 (131) days while late genotype was obtained from 2351 (113 days). The highest value of plant height was measured from genotype 6786 (132.8 cm), whereas the short plant height was obtained from genotype 2351 (64.8 cm). The highest seed yield was produced from Bole genotype (24.18 qt/ha), whereas the lowest seed yield was obtained from genotype 6786 (6.8 qt/ha). Chemical composition indicated genotype 2351 was the highest in total ash (TASH) and neutral detergent fiber (NDF) whereas less in crude protein (CP) genotype 6786 was the highest in crude protein (CP) while Bole variety had the highest in dry matter (DM), acid detergent lignin (ADL), acid detergent fiber (ADF) and organic matter (OM). This study implied that 6786 genotypes were well adapted and productive regarding the plant height (131.8 cm) and biomass yield (4.4 t/ha), which is hopeful to fill the low quantity ruminant feed gap. Besides, the nutritional values were promising, particularly the crude protein (CP) in 6786 genotypes. Thus it could be possible to conclude that cowpea genotype, especially 6786 used as a protein supplement. Based on its adaptability, high biomass, plant height, good CP content 6786 genotype is recommended for further promotion in the midland of East Guji zone and similar agro-ecologies.

Key Words: *Cowpea, Genotype, Adaptability and Nutritive value.*

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I. Introduction

Feed shortage in quantity and quality remains the leading constraint to good animal performance in Ethiopia (Yayneshet et al., 2009). Natural pasture and crop residues are the main feed sources (feedstuffs). Feedstuffs of such composition are insufficient to provide year round supply of adequate quantity and quality of nutrients beyond maintenance (Hindrichsen et al., 2001). Legumes are the most important forage plants that substantially improve livestock feed as they can provide the essential protein for animals, improving soil fertility, food crop production, and household nutrition through a more reliable supply of milk and meat (Akinlade et al., 2005; Alemayehu, 1997). Cowpea (*Vigna unguiculata* (L.) is a leguminous crop grown throughout West Africa, often in association with pearl millet (Pennisetum glaucum L.) and sorghum (Sorghum bicolor L.). Cowpea is well adapted to the harsh growing conditions, including low soil fertility, high temperatures, and drought (Turk et al., 1980). Cowpea can fix nitrogen to improve soil fertility and cropping system productivity. Additionally, farmers feed cowpea fodder to livestock to increase income and collect the manure produced for use in their fields, thereby reduces farmers' reliance on commercial fertilizers and sustain soil fertility (Odion, et al. 2007; Akinlade, et al., 2005). Previous studies with cowpea (Gwanzura et al., 2012; Akinlade et al., 2005; Ebro et al., 2004; Alemayehu, 1997) indicated this legume improves soil fertility and enhances the intake and utilization of poor quality roughage, consequently improves livestock production and productivity. Another important feature of cowpea is its ability to suppress weeds, particularly Striga species (Dawit et al., 2009). Therefore, this experiment was conducted to evaluate and identify adaptive, high quality yielding cowpea genotypes in the midland of Guji east Guji zone.

II. Materials and Methods

Description of the study area

The experiment was carried out at Adola sub-site of Bore Agricultural Research Center, Adola district, Guji Zone of Oromia. Adola district is located around 470 km from Addis Ababa and 120 km from the zonal capital city, Negele Borena. It is an area where a mixed farming and sami- nomadic economic activity occurs, which is the local people's major livelihood. The total area of the district is 1254.56km$^{2.}$ The district is situated at 5^{o}44'10" - 6^{o}12'38" N latitudes and 38^{o}45'10" - 39^{o}12'37" E longitudes. The district is characterized by three agro-climatic zones, namely highland 11%, mid-land 29% and low-land 60%, respectively. The district's major soil type is nitosols (red basaltic soils) and orthic Acrosols (Yazachew and Kasahun, 2011).

Experimental treatments and design

The study was executed using Bole, 6786 and 2351 genotypes. The experiment was conducted in a randomized complete block design with three replications. Seeds were sown in rows at a spacing of 30 cm with seed rate of 30 kg ha^{-1}. Plot size of 1.8 m x 3 was used. NPS fertilizer at 100 kg ha^{-1} was uniformly applied for all treatments at sowing time

Data collection methods

Relevant data including days 50% flowering, days to seed maturity, plant height, seed yield and nutritive value were collected. Seed yield weight was calculated at 10% moisture content. Seed yield weight was calculated at 10% moisture content. At 50% flowering stage, each plot's middle rows were harvested for dry matter herbage determination and chemical analysis. Plants were harvested at ground level and fresh biomass weighed immediately using a 0.1 g scale. A sub-sample of 15-20% of the total weight was separated and put into a paper bag for dry matter herbage determination. The samples were oven-dried at 105 ^{0}C for 24 hours. To determine grain yield the pods were harvested from the rest rows at optimum physiological maturity by hand picking.

Statistical analysis

All collected data were analyzed using a general linear model procedure SAS (SAS, 2002) version 9.1. Means were separated with least significant difference (LSD) at 5% significant level. The statistical model for the analysis data was: $Y_{ijk} = \mu + A_j + B_i + e_{ijk}$

Where

Y_{ijk}= response of variable under examination; μ = overall mean; A_j = the jth factor effect of treatment/ cultivar; B_i = the ith factor effect of block/ replication, e_{ijk} = the random error.

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III. Results and Discussion

Yield and yield components

The mean value of agronomic and yield parameters of cowpea genotypes are shown in table 01. The analyzed result shows that days to 50% flowering, days to maturity, plant height and seed yield was significantly (P<0.05) different among treatments. Genotype 6786 attained early 50% flowering (72.8 days) followed by genotype 2351 (75.9 days) while genotype Bole late flowered (82.3 days) of 50% flowered as compared to other genotypes. Our results for days to 50% flowering were higher than reported by Cobbinah et al. (2011); Rao and Shahid (2011); Agza et al. (2012) and Solomon and kibrom (2014), possibly due to ecological and genetic differences.

Early matured genotype was 2351 (113 days) followed by Bole genotypes (127.9 days) while late matured genotypes were obtained from 6786 (131 days) to set seed when compared to rest genotypes. Early maturity is a relatively important agronomic characteristic measured by such criteria as days to flowering or days to maturity (Singh and Rachie, 1985). Our results for days 50% flowering and maturity were highly higher than reported by Cobbinah et al. (2011), who found average results of 39.5 and 51.6 days to reach 50% flowering and maturity for cowpea genotypes in Ghana, respectively. The result of the current study for days to 50% flowering was higher than reported by Agza et al. (2012) and Rao and Shahid (2011), who found average results of 63 and 63.7 days, respectively, possibly due to ecological and genetic differences.

The highest plant height was measured from genotype 6786 (132.8 cm) followed by Bole genotype (66.8 cm) whereas the short plant height was obtained from genotype 2351 (64.8 cm). The highest seed yield was produced from Bole genotype (24.18 qt/ha) followed by genotype 2351 (19 qt/ha) while the lowest seed yield was obtained from genotype 6786 (6.8 qt/ha). Non-significant differences to biomass yield, pod per plant, and seed yield were observed between treatments (P > 0.05). However, numerically had high yield was recorded among treatments. The highest biomass yield was produced from genotype 2351 (5.9 ton/ha), followed by genotype 6786 (4.4 ton/ha) while the low biomass yield was obtained from Bole variety (3.7 ton/ha). The highest pod per plant produced from genotype 6786 (12.7) followed by genotype 2351 (10.2) whereas the lowest pod per plant was obtained from Bole genotype (9.11). The highest pod length was obtained from 6786 genotypes (3.27 cm) followed by Bole genotype (2.9 cm) while the short pod length was obtained from genotype 2351 (1.7 cm) and also expressed in Figure 01.

Table 01. Combined yield and yield attributes of three cowpea genotypes

Varieties	DsM	Ppp	PoL (cm)	PH (cm)	BMY (t/ha)	SY(qt /ha)
2351	113b	10.2	1.7	64.8b	5.9a	19ab
6786	131.a	12.7	3.274	131.8a	4.4b	6.8b
Bole	127.9a	9.11	2.9	66.8b	3.7b	24.2a
Mean	124	10.7	2.6	87.7	4.7	16.6
CV	9.9	69.9	80.6	23.7	30.5	96.6
LSD (5%)	*	Ns	Ns	*	Ns	*

[a,b] Mean in a column within the same category having different superscripts differ (p < 0.05) DF=flowering date, DM=maturity date, Ppp=Pod per plant, PoL=Pod length centimeter, PH=plant height centimeter, BMY= biomass yield tone per hectare, SY=grain yield, Cv=Coefficient of variation, LSD= Least significant difference.*=significant, ns=non-significant.

Chemical Composition

The chemical composition indicated that DM, CP, NDF, ADL, ADF, TASH and OM was not significantly (P>0.05) different among treatments. However, numerically had high yield was recorded among treatments. Genotype 2351 was highest in TASH and NDF while less in CP, genotype 6786 was highest in CP whereas less in DM, NDF, ADL and OM, Bole variety had the high in DM, ADL, ADF and OM while less in TASH compared the rest treatments. The minimum CP content in the ruminant diet should be around 6.0 - 8.0% of dry matter for adequate rumen microorganism activity (Van Soest, 1994), suggesting that hay CP content in investigated cowpeas are more than twice needed rations. Based on its CP% content, Gwanzura et al. (2012) suggested that cowpea has the potential of being utilized as protein supplement for ruminants on low quality roughages.

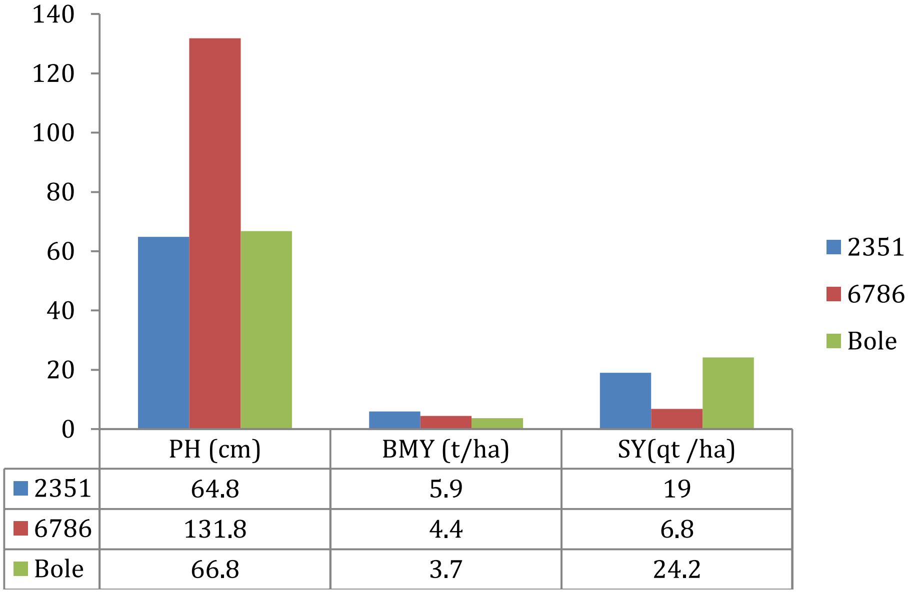

Figure 01. Mean plant height, biomass yield and seed yield of cowpea cultivars.

Akinlade et al. (2005) realized that supplementation of dairy cows with cowpea hay stimulated maize stover's voluntary intake, increasing milk yield. Ebro et al. (2004) revealed that legume supplementation is an appropriate option where protein sources such as oilseed cakes and animal origin are produced in limited quantities and beyond most smallholder farmers' economic reach in Ethiopia. The mean CP content obtained in the present study was agreed with by Agza et al. (2012) and Ayana et al. (2013), who reported that cowpea's contents were 20.33 and 23.9%, respectively. The maximum NDF content of diet that does not hinder production may be as high as 750 g/kg for mature beef cows and as low as 150 g/kg DM for growing or fattening ruminants (Barnes et al. 1995). NDF and ADF contents determined in the present study were higher than reported for cowpea genotypes (Agza et al. 2012; Ayana et al. 2013). This difference could be due to harvest time and duration of sample analyzed at the laboratory (Table 02).

Table 02. Mean chemical composition of Cowpea genotypes.

Genotypes	DM	CP	NDF	ADL	ADF	TASH	OM
2351	90.3	22	82.4	9	35.9	13.7	76.5
6786	89.2	27.4	67.1	7.5	37.3	12.8	76.4
Bole	90.4	24.8	74.1	13.1	39	12.2	78.3
Mean	89.9	24.7	74.5	9.8	34.7	12.9	77

AD= Acid Detergent Fiber; AD= Acid Detergent Lignin; CP= Crude Protein; ND= Neutral Detergent Fiber and O= Organic Matter; TA=Total Ash; D=Dry matter

IV. Conclusion

This study indicated that genotype 6786 was well adapted and productive regarding the plant height (131.8 cm) and biomass yield (4.4 t/ha), which is hopeful to fill the low quantity ruminant feed gap supply the community. The nutritional values were promising the crude protein (CP) content in genotype 6786, particularly. Thus it could be possible to conclude that the cowpea genotype 6786 was used as a protein supplement for the midland of East Guji. Based upon its adaptability, high biomass plant height and good CP of genotype 6786 are recommended further promotion in the midland of East Guji zone and similar agroecology.

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References

[1]. Agza, B., Binyam, K., Solomon, Z., Eskinde, A. and Ferede, A. (2012). Animal feed potential and adaptability of some cowpea (*Vigna unguiculata*) varieties in northwest lowlands of Ethiopia. Journal of Agricultural Research, 1(11), 478–483.

[2]. Akinlade, J. A., Smith, J. W., Raji, A. M., Busari, A. A., Adekunle, I. O. and Adewumi, M. K. (2005). Effect of Two Cowpea (*Vigna unguiculata*) Fodder Cultivars as Supplements on Voluntary Intake, Milk Yield and Manure Production of Bunaji Cows. Journal of Agriculture and Rural Development in the tropics and Subtropics, 106(2), 105–112.

[3]. Alemayehu, M. (1997). Conservation based forage development for Ethiopia. Self Help Development International and Institute for Sustainable Development. Berhan ena Selam Printing Press, AddisAbaba, Ethiopia.

[4]. Ayana, E., Estefanos, T., Ashenafi, M. and Abubeker, H. (2013). Advanced evaluation of cowpea (Vigna unguiculata) accessions for fodder production in the central rift valley of Ethiopia. Journal of Agricultural Extension and Rural Development, 5(3), 55-61

[5]. Barnes, R. F. W., Azika, S. and Asamoah-Boateng, B. (1995). Timber, cocoa, and crop-raiding elephants: a preliminary study from southern Ghana. Pachyderm, 19, 33-37.

[6]. Cobbinah, F. A., Addo-Quaye, A. A. and Asante, I. K. (2011). Characterization, evaluation and selection of cowpea (*Vigna unguiculata* (L.) Walp) accessions with desirable traits from eight regions of ghana. ARPN Journal of Agricultural and Biological Science, 6 (7), 21-32.

[7]. Dawit, M., Sisay, K., Tizazu, D. and Girma, T. (2009). Effect of Maize and Legume Intercropping on (*Striga hermonthica*) Infestation in Metekel Zone. Ethiopian Journal of Weed Management, 3(1), 13-19.

[8]. Ebro, A., I. V., Nsahalai, Yami, N. N. and Umunna (2004). Effect of supplementing graded levels of forage legumes on performance of crossbred calves fed Tef *(Eragrostis tef)* straw. Journal of Applied Animal Research, 26, 107–112 https://doi.org/10.1080/09712119.2004.9706517

[9]. Gwanzura, T., Ng'ambi, J. W. and Norris, D. (2012). Nutrient composition and tannin content of forage sorghum, cowpea, lablab and mucuna hays grown in Limpopo province of South Africa. Asian Journal of Animal Sciences, 5(12), 1-7. https://doi.org/10.3923/ajas.2012.256.262

[10]. Hindrichsen, I. K., P. O. Osuji, A. A., Odenyo, J. Madsen and T. Hvelplund (2001). Effects of supplementation with four multipurpose trees and Labalab purpureus on rumen microbial population, rumen fermentation, digesta kinetics and microbial protein supply of sheep fed maize stover ad libitum. TSAP Proceedings, 28, 98-119.

[11]. Odion, E. C., Asiribo, O. E., Ogunlela, V. B., Singh, B. B. and Tarawali, S. A. (2007). Strategies to improve and sustain food production capacity in the savanna: The role of leguminous fodder crops in maintaining soil fertility and health. The Journal of Food, Agriculture and Environment. 5, 338-344.

[12]. Rao, N. K. and Shahid, M. (2011). Potential of cowpea [*Vigna unguiculata* (L.) Walp.] and guar [*Cyamopsis tetragonoloba* (L.) Taub.] as alternative forage legumes for the United Arab Emirates. Emirates Journal of Food and Agriculture, 23 (2), 147-156. https://doi.org/10.9755/ejfa.v23i2.6349

[13]. SAS (2007). (9.2 version). SAS Users' guide, Statistical Analysis System (SAS) Institute, Inc, Cary, NC.

[14]. Singh, S. R. and Rachie, K. O. (eds) (1985). *Cowpea: Research, Production and Utilization*, Wiley, Chichester.

[15]. Solomon, G. and G. Kibrom (2014). Forage production potential and nutritive value of cowpea (*Vigna unguiculata*) genotypes in the northern lowlands of Ethiopia, Journal of Agricultural Research and Development, 5(4), 066-071.

[16]. Turk, K. J., Hall, A. E. and Asbell, C. W. (1980). Drought adaptation of cowpea. I. Influence of drought on seed yield. Agronomy Journal, 72, 413-420. https://doi.org/10.2134/agronj1980.00021962007200030004x

[17]. Van Soest, P. J. (1994). Nutritional ecology of the ruminant, Comstock publishing associates. A Division of Cornell University Press, Ithaca and London, UK.

[18]. Yayneshet, T., L. O. Eik, S. R. Moe (2009). The effects of enclosures in restoring degraded semi-arid vegetation in communal grazing lands in northern Ethiopia. Journal of Arid Environments, 73, 542-549. https://doi.org/10.1016/j.jaridenv.2008.12.002

[19]. Yazachew, E. and Kasahun, D. (2011). The National regional government of Oromia, Physical and socio economic profile of Guji zone districts. Bureau of Finance and Economic Development. The National Regional Government of Oromia, Addis Abeba.

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