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Evaluation of Pigeon pea (Cajanus Cajan) varieties at Adola, Guji zone of Oromia

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Abstract: A study was conducted to identify adaptable, high biomass, good quality and seed yield of Pegeon pea cultivars at Adola sub-site of Bore Agricultural research center. Four pegeon pea cultivars Tsigas, Degagsa-75, Belabas-27 and 16555 were tested in RCBD with three replications. The analysis of variance revealed that significant (P<0.05) differ in days to 90% maturity were observed among cultivars. Among tested cultivars, Belabas 27 was significantly earlier (162 days) to maturity, while the late matured cultivar was Degagsa (203 days). Analysis of variance showed highly significant differences (P<0.01) were observed among cultivars for the number of primary branches per plant. A higher branch number was recorded for Tsigas cultivar (21.6) whereas the lowest branch number was obtained from cultivar Degagsa-75 (9.75). The cultivars were significant (P<0.05) differ for pod length. The long pod was recorded from cultivar 16555 (5 cm) while the short pod length was recorded from cultivar Belabas -27 (3.14 cm). Cultivars were significant (P<0.05) varied for plant height. The long plant height was measured from cultivar Degagsa-75 (159.75 cm) followed by Tsigas (104.9 cm) whereas the short pant height was obtained

from cultivar Belabas-27 (78.63 cm). Significant variations (P<0.05) in biomass yield between genotypes were observed (Table 2). Superior biomass yield was produced from Tsigas cultivar (2.17 ton/ha) followed by cultivar 16555 (1.27 ton/ha) while the low biomass yield was obtained from Degagsa-75 cultivar (0.97 ton/ha). In addition to the nutritional values were promising particularly the crude protein (CP) content in cultivar Tsigas. Based upon its adaptability, high biomass yield, seed yield and good CP of cultivar Tsigas and 16555 are recommended for further promotion in the midland of Guji zone and similar agro-ecologies.

Keywords: Cajanus cajan, Nutritive value, Adola, Cultivar, variety

1. Introduction

The feed is the most important input in livestock production and its adequate supply throughout the year is an essential prerequisite for any substantial and sustained expansion in livestock production [1], [2]. According to [3] animal feeds including; natural pasture, fodder crops, fodder trees, crop residues and non-conventional feeds are used in different parts of Ethiopia. Green fodder (grazing) is the major type of feed (54.59%) followed by crop residues (31.60%), hay (6.81%) and industrial byproducts (1.53%) [4].

According to [5] reported that feed in terms of both quantity and quality is a bottleneck to livestock production in Ethiopia. This problem of feed shortage is more aggravated during the dry season [6]. Even during years of the good rainy season, forage is not sufficient to feed livestock in the highlands [7].

Pigeon pea (Cajanus cajan (L.) is one of the leguminous crops that have been cultivated for human and livestock consumption in many parts of the world. Pigeon pea (Cajanus cajan) plant is a legume belonging to the family of “Fabaceae” or “Leguminosae” and is widely used as fodder and feed for livestock [8].

Pigeon pea (Cajanus Cajan (L.) is one of the most common tropical and subtropical legumes cultivated for its edible seeds. Pigeon pea is fast-growing, hardy, widely adaptable, and drought-resistant [9]. Thanks to drought resistance it can be considered of utmost importance for food security regions places where rain failures are prone to occur [10]. At the end of the dry season, pigeon pea provides green forage of outstanding value when other forages have disappeared [11].

Cajanus Cajan has numerous uses in animal feeding. The leaves and pods are valuable and palatable protein-rich fodder. Leaves are sometimes used to replace alfalfa in ruminant’s diets where alfalfa cannot be grown. Seed processing by-products and sometimes the seeds themselves are used as livestock feed [12]. The seeds can be fed to poultry, and mixtures of pigeon pea with maize grain were successful in Hawaii. Bees actively feed on pigeon pea and produce a honey with a distinctive color (greenish) in the comb [12]. Pigeon pea is also a good host for lac insects and silkworms [13].

Pigeon pea is a tropical grain legume and is among important pulses grown for food, feed and soil fertility improvement. It is mainly grown in India and tropical and subtropical regions of Africa, Asia and America. It is a cheap source of protein (20%), other soluble vitamins and essential amino acids [14]. In Southern and Eastern Africa, pigeon pea has been neglected and very little attention has been put in its research [15].

Farmers in the region still use unimproved late-maturing cultivars due to poor access to improved seed [16]. Previous evaluations of Pigeon pea (Cajanus cajan) has been limited to adaptation and biomass yield to growth features, forage and seed productivity and forage quality in Guji Zone. Therefore, the study has undertaken the objective to identify and evaluate better adaptable, biomass yield, seed yield and quality performance of some Pigeon pea cultivars.

2. Materials and Methods

2.1. 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 at a distance of 470 km from Addis Ababa and 120 Km from the zonal capital city, Negele Borena. It is an area where mixed farming and Sami- nomadic economic activity takes place, which is the major livelihood of the local people. The total area of the district is 1254.56km2. The district is situated at 5o44'10" - 6o12'38" N latitudes and 38o45'10" - 39o12'37" E longitudes. The district is characterized by three agro- climatic zones, namely highland 11%, mid-land 29% and low-land 60% respectively. The major soil type of the district is tools (red basaltic soils) and orthic Acrosols [17].

2.2. Experimental treatments and design

The study was conducted using Tsigas, Degagsa, Belabas and 16555. The experiment was conducted in a randomized complete block design (RCBD) with three replications. Seeds were sown in rows spaced 1 m with a seed rate of 30 kg ha1. Plot sizes of 4 m x 3 m were used. NPS fertilizer at 100 kg ha-1 was uniformly applied for all treatments at sowing time.

2.3. Data collection

Data were collected on days to 50% flowering, days to seed maturity, plant height, several branches, pod per plants, pod length, seed per pods, leaf to stem ratio, biomass yield, seed yield and nutritive value. Seed yield weight was calculated at 10% moisture content. To determine grain yield, the pods were harvested from the rest rows at optimum physiological maturity by handpicking.

2.4. Chemical analysis

For forage quality analysis, chopped herbage of the three replications was pooled into one and properly homogenized and one representative subsample was taken for each cultivar. The DM and ash contents were determined by oven drying at 105°C overnight and by igniting in a muffle furnace at 500°C for 6 hours, respectively. Nitrogen (N) content was determined by Kjeldahl method and CP was calculated as N x 6.25 [18]. The neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) fractions were analyzed according to [19].

2.5. Statistical analysis

All collected data were analyzed using a general linear model procedure SAS [20] version 9.1. Means were separated with the least significant difference (LSD) at 5% significant level. The statistical model for the analysis data was: $Yijk= \mu + Aj + Bi + eijk$

Where Yijk= response of variable under examination, μ = overall mean, Aj = the jth factor effect of treatment, Bi = the ith factor effect of block/ replication, eijk = the random error.

3. Results and Discussions

3.1. Analysis of Variance and mean performances of pigeon pea cultivars

The experiment was conducted on four improved pigeon pea (Cajanus Cajun) genotypes to select high yielder and best performing in all traits. Mean squares of various agronomic characters are presented in Table 1 whereas; mean values of different traits are presented in Table 2.

Days to 50% Flowering

Significant variations ($P<0.05$) in days to flowering between cultivars were observed (Table 2). Tsigas cultivars showed significantly shorter days to 50% flowering (92.6 days) followed by cultivars 16555 (109 days), while Degagsa-75 cultivar was late flowered (124 days) of 50% flowered as compared to other genotypes, this might be possibly due to genetic differences of the genotypes. This result has confirmed with the previous reports [21, 22].

Days to 90% Maturity

Analysis of variance revealed that significant variation ($P<0.05$) in days to 90% maturity was observed among cultivars (Table 2). Belabas-27 cultivar showed significantly short (162 days) to maturity followed by cultivars 16555 (186 days), while late matured cultivars were Degagsa-75 (203 days) when compared to the other cultivars.

Number of primary branches per plant

Analysis of variance showed highly significant differences ($P<0.01$) were observed among cultivars for a number of primary branches per plant (Table 2). A higher branch number was recorded for Tsigas cultivar (21.6) whereas the lowest branch number was obtained from cultivar Degagsa-75 (9.75). This result conforms with the result[23] of and disagreed with the result[24] of different pigeon pea lines and cultivars.

Pods per plant and seeds per pod

Analysis of variance showed no significant differences among cultivars for pods per plant and seeds per pod (Table 2). This result has disagreed with the report of [25, 26].

Pod length per plant

The cultivars were significant (P<0.05) differ for pod length. The longest pod was recorded from cultivars 16555 (5 cm) followed by cultivar Degagsa-75 (5.16 cm) while, the short pod length was recorded from cultivars Belabas-27 (3.14 cm). This result conforms with (Ezeaku et al., 2008).

Plant Height

The cultivars were significant (P<0.05) varied for plant height. The long plant height was measured from Dagagsa-75 cultivar (159.75 cm) followed by Tsigas (104.9 cm) cultivar whereas the short pant height was obtained from Belabas-27 (78.63 cm) cultivar. This result is the same as the result of (Ezeaku et al., 2008).

Leaf to a Steam ratio

There were significant (P<0.05) differences for leaf to a steam ratio of the tested cultivars. The highest leaf to steam ratio was obtained from Tsigas cultivar (1.07) followed by Belabas-27 cultivar (0.71) whereas the low leaf to steam ratio was obtained from cultivars 16555 (0.67).

Biomass Yield

Significant variations (P<0.05) in biomass yield between cultivars were observed (Table 2). The long biomass yield was produced from Tsigas cultivars (2.17 ton/ha) followed by cultivars 16555 (1.27 ton/ha) while the low biomass yield was obtained from Belabas-75 cultivars (0.97 ton/ha).

Seed Yield

Cultivars were showed no significant differences (P<0.05) in seed yield performance, but numerically had different values (Table 2). The highest seed yield was recorded from Tsigas cultivars (29 qt/ha) followed by Belabas-27 cultivar (23.1 qt/ha), whereas the lowest seed yield was obtained from 16555 cultivars (13.2 qt/ha). This result is similar to the report of (Sharma et al., 1981) with a mean yield of 1.37 t/ha.

3.2 Chemical Composition

Table 3, shows the chemical composition of the four pigeon pea cultivars. Cultivar Belabas-27 had the highest dry matter of (9.7) followed by cultivar 16555 recorded the lowest of (89.95). Tsigas cultivar recorded the highest CP of (30.4) while cultivar 16555 recorded the lowest crude protein of (23.1). Cultivar 16555 recorded the highest NDF of (68.6) while cultivar Tsigas recorded the lowest NDF of (47.3). Cultivar Tsigas recorded the highest ADF of (42.9) while cultivar Belabas-75 recorded the lowest NDF of (37.5). Cultivar Tsigas recorded the highest ADL of (17.4) while cultivar 16555 recorded the lowest ADL of (5.2). Cultivar Tsigas recorded the highest crude protein OM of (85.1) while cultivar 16555 recorded the lowest OM of (79.2). Cultivar Dagagsa-75 recorded the highest TASH of (9.3) while cultivar Belabas- 27 recorded the lowest TASH of (6.7). Cultivar Belabas-27 recorded the highest OM of (85.1) while cultivar 16555 recorded the lowest OM of (79.2).

Table 1. Analysis of variance for agronomic traits of the pigeon pea cultivars.

Source of variations	d.f	Mean Squares									
		50%DF	90%M	Nb	Ppp	Pl cm	Spp	Ph cm	LSR	Syqt	BMt
Replication	2	114.46	2155.2	360.5	2.71	1623.5	1.9	3865.4	0.10	96.85	0.19
cultivar	3	1071.9*	2023.5*	156.62**	5.7**	2493.4*	1.75*	7301.7*	0.21*	103.04*	1.81*
Error	6	110.8	2172.1	0	0.64	1752	2.84	1829.3	0,07	53.02	0.18
Total	17										

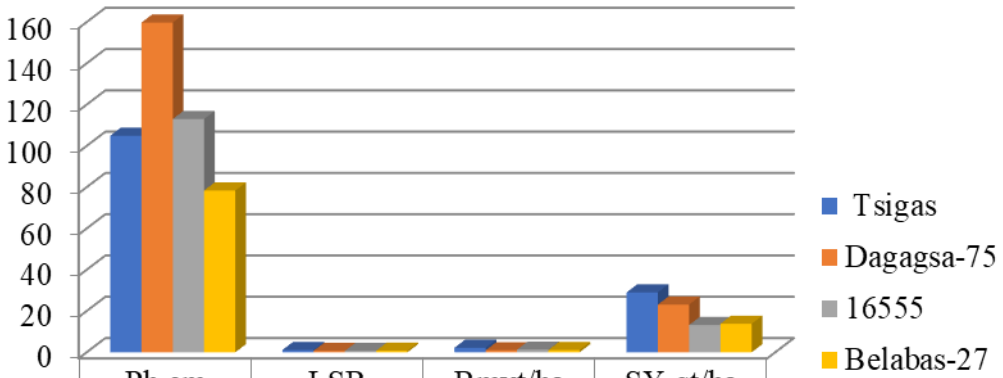
(p<0.05) 50%DF= days to 50% flowering, 90%DM= 90% maturity date, Mbr= number of prim ary branches, Ppp= Pod per plant, Pl= Pod length centimeter, Spp= seed per pod, Ph= plant height in centimeter, LSR=leaf to steam ratio, Bmyt/ha= biomass yield tone per hectare, SY= seed yield tone per hectare, Cv= Coefficient of variation, LSD= Least significant difference,* = significant, Ns=None significant.

Table 2. Combined mean values of different agronomic traits of four pigeon pea cultivars.

Cultivars	**50%DF**	**90%M**	**Npbr**	**Ppp**	**Pl cm**	**Spp**	**Ph cm**	**LSR**	**Bmyt/ha**	**SY qt/ha**
Tsigas	92.6c	193	21.6a	55a	3.9b	3.5	104.9ab	1.07a	2.17a	29
Dagagsa-75	124a	203	9.75d	89a	5.16a	4.5	159.75a	0.69b	0.97b	23.1
16555	109b	186	12.2c	87a	5a	4.8	113ab	0.67b	1.27b	13.2
Belabas-27	114ab	162	13.4b	52.5a	3.14b	4.3	78.36b	0.74b	1.078b	13.8
Mean	110	185.7	14	68.9	4.2	4.2	112.57	0.7	1.34	88
CV	9.54	25	0	60.7	19	39.6	37.9	35	31.35	362
LSD (5%)	*	NS	*	Ns	*	NS	*	*	*	Ns

a,b,c Mean in a column within the same category having different superscripts differ significantly (p<0.05) 50%DF=days to 50% flowering, 90%DM= 90% maturity date, Mpbr=

number of primary branches, Ppp=Pod per plant, Pl=Pod length centimeter, Spp=seed per pod, Ph=plant height centimeter, LSR=leaf to steam ratio, Bmyt/ha= biomass yield tone per hectare, SY=seed yield tone per hectare, Cv=Coefficient of variation, LSD= Least significant difference,*= significant, Ns= None significant.



	Ph cm	LSR	Bmyt/ha	SY qt/ha
Tsigas	104.9	1.07	2.17	29
Dagagsa-75	159.75	0.69	0.97	23.1
16555	113	0.67	1.27	13.2
Belabas-27	78.36	0.74	1.078	13.8

Figure 1. Mean plant height, biomass yield, leaf to stem ratio and seed yield of pigeon pea cultivars.

Table 3. Mean chemical compositions of four pigeon pea cultivars

Cultivars	DM	TASH	OM	NDF	ADF	ADL	CP
16527	91.7	6.7	85.1	64.4	40.1	8.5	24.4
Tsigas	89.2	8.4	80.8	47.3	45.9	17.4	30.4
11575	89.3	9.3	80.1	64.4	37.5	8.1	23.5
16555	87.95	8.9	79.2	68.6	42.9	5.2	23.1

ADF= Acid Detergent Fiber; ADL= Acid Detergent Lignin; CP = Crude Protein; NDF = Neutral Detergent Fiber and OM = Organic Matter; TASH=Total Ash; DM=Dry matter.

4. Conclusion and recommendations

The result of this study indicated that cultivar Tsigas was well adapted and being productive regarding the biomass yield (2.17t/ha), leaf to stem ratio (1.07) and seed yield (29qt/ha) and biomass yield of cultivar 16555 (1.27 t/ha) which is hopeful to fill the gap of low quantity ruminant feed supply of the community. In addition to the nutritional values were promising particularly the crude protein (CP) content in cultivar Tsigas. Thus it could be possible to conclude that the Pigeon pea cultivars Tsigas and 16555 cultivars used as a protein supplement for the midland of Guji. Based upon its adaptability, high biomass yield, seed yield and good CP of cultivar Tsigas are recommended for further promotion in the midland of Guji zone and similar agro-ecologies.

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