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YIELD AND YIELD RELATED PERFORMANCE OF COWPEA (*Vignia unguiculata* L.) VARIETIES TESTED AT DIFFERENT FERTILIZER USE UNDER IRRIGATION, CENTRAL GONDAR ZONE, ETHIOPIA

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Abstract

Inadequate quantity and quality feeds is the major constraints to livestock production in majority of smallholder farmers in Ethiopia. This necessitates the need to follow economically viable forage production. A study was conducted to evaluate the yield and yield related performance of cowpea (Vignia unguiculata L.) varieties under irrigation in 2017 and 2018 years. The experiment was laid down in a split plot design with randomized complete block design (RCBD) arrangement in four replications. There were two main plots of which one was planted with fertilizer and the other one without fertilizer for comparison and the sub plot treatments were eight varieties of Cowpea (Vignia unguiculata) (ILRI 9333, ILRI 9334, ILRI 11114, ILRI 12688, ILRI 12713, Kenkety, Black eye bean and IT92KD258-9). The data collected consisted of plant height (cm), number of branches per plant, forage biomass yield (t ha^{-1}), dry matter yield (t ha^{-1}), leaf to stem ratio, number of pods per plant, number of seeds per pod, grain yield (kg ha^{-1}), thousand seed weight (g) and haulm yield (t ha^{-1}). All data were subjected to analysis of variance procedures, with significance test at $p<0.05$. The results revealed that highest dry biomass yield (t ha^{-1}) was recorded when Cowpea varieties ILRI 9334, ILRI 11114, ILRI 12688 and IT92KD258-9 planted with fertilizer. The highest haulm yield was obtained from Cowpea varieties ILRI 9334, ILRI 11114 and ILRI 12713 when planted with fertilizer and when ILRI 9334, ILRI 12688, ILRI 12713 and IT92KD258-9 Cowpea varities planted with out fertilizer. Cowpea varieties Kenkety and IT92KD258-9 produced higher grain yield compared to other varieties. Cowpea varieties ILRI 9333, ILRI 11114, ILRI 12688, ILRI 12713 and IT92KD258-9 when planted with and with out fertilizer; when variety ILRI- 9334 and Kenkety planted only with fertilizer and also variety Black eye bean when planted with out fertilizer was found economically profitable. Therefore, based on the study results, planting Cowpea varieties ILRI 9334, ILRI 11114, ILRI 12688 and IT92KD258-9 with 100 kg ha^{-1} NPS fertilizer appears to be more preferable regarding biomass yield and were found potentially profitable.

Key words*: Cowpea, dry matter yield, grain yield, variety.*

INTRODUCTION

The farming system in Central Gondar zone predominantly mixed crop- livestock production. However, there is repeated crop failure due to short rainy season, erratic rain fall, erosion, and poor soil fertility, among other factors. There is also limited land availability for crop production in the area. Thus livestock production plays a vital role in the livelihood of the farmers not only during bad production years, but also during normal years. However, livestock production in the area is constrained by feed shortage both in terms of quality and quantity.

A reason for feed shortage is that livestock production, particularly feed development, is given a second priority to crop production. This is reflected in the basis towards food crop production by the extension system and farmers reluctance to devote land and labor for forage production (Yayneshet et al., 2009).

Because of the limited land available for food crop production sole forage production may not be feasible in the mixed crop- livestock production system of the area where by food crop production is given high priority.

There for it is very important to seek multipurpose type forage crop varieties which are adaptable and high yielding for the study area and similar agro-ecologies.

Cowpea is one of the candidate forages which is characterized by multipurpose and short-lived annual legume that can best be inter-cropped with cereals.

Besides to its suitability to inter cropping, crop residue (haulm) from cowpea is a very important fodder resource which contains higher crud protein (21%) in the dry haulm (Singh & Tarawali, 1997).

In addition to its food and forage value cowpea is very important in improving soil fertility through the process of nitrogen fixation (Sanginga et al., 2003; Abayomi, 2008). Having all these advantages cowpea can be a potential feed and food crop in the mid land areas of central Gondar zone. Considering the above mentioned advantages the development sector trying to introduce cowpea though the adoption is very low due to low productive varieties used. To tackle this challenge, searching for adaptive and productive cow pea variety is becoming a great deal.

However, there were no recommended varieties in the potential mid land areas of North Gondar zone and the use of chemical fertilizer on this crop is remained under deviate.

The current study was, therefore, conducted with the objective to estimate the yield potential of different varieties of cowpea with and without fertilizer for future sustainable forage production under irrigation in the study area.

MATERIALS AND METHODS

Description of study area

The study was conducted at West Dembia district, Melkam wuha village; 48 km south of the Zonal capital, Gondar, which is located between latitude 12º 17'42.18'' N and longitude 37º 13' 25.39'' E at an elevation of 1856.4 m.a.sl. The soil texture of the study area is sandy loam, good in water- holding capacity and fertility. The area has a moist tropical climate and has the mean monthly temperature of 18.34ºC. Based on 10 years (2008-2017) data, the total annual rainfall ranges between 665 mm and 1524 mm with a mean value of 1095 mm.

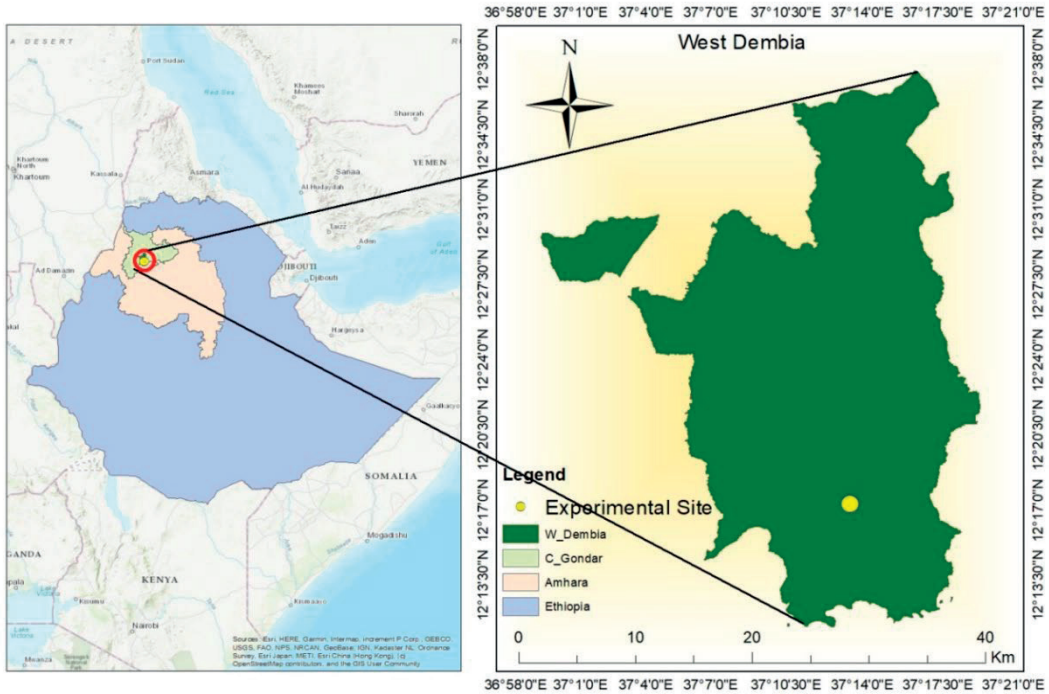

Figure 1. Map of the study area in West Dembia district, Central Gondar zone, Amhara region, Ethiopia

Treatments and experimental design

The experiment was laid down in a split plot with RCBD arrangement in four replications. The main plot factor was fertilizer (one was planted with fertilizer and the other one without fertilizer) and the sub plot factor was variety (eight accessions of Cowpea (*Vignia unguiculata*) (ILRI 9333, ILRI 9334, ILRI 11114, ILRI 12688, ILRI 12713, Kenkety, Black eye bean and IT92KD258-9) adaptive to the low land areas of Ethiopia. The varieties were collected from International Livevstock Research Institute (ILRI) forage seed unit. The plot size was 2.4*2.8 m with spacing of 40 cm between rows and 20 cm between plants. Spacing for both between plots and replications was 1m. For the main plot which was planted

with fertilizer NPS at the rate of 100 kg ha^{-1} was applied at the time of planting.

Sampling, data collection and processing

In this experiment, after planting in the field the performances of varieties were evaluated with respect to plant height at forage harvest, number of branches per plant, forage biomass yield (t ha^{-1}), dry matter percent (%), dry matter yield (t ha^{-1}), leaf to stem ratio, number of pods per plant, number of seeds per pod, grain yield (kg ha^{-1}), thousand seed weight (g) and haulm yield (t ha^{-1}).

During sampling each plot was divided in to two halves crosswise with an effective plot size of 2.4*1.4 m. One half was used for forage sampling and the other half for seed sampling. Forage sampling was done at 50% blooming stage while grain yield of Cowpea was determined at 12.5% moisture content. In each case, sampling was done from the middle two rows excluding the guard rows. Immediately after forage harvested fresh yield was measured by using Salter balance having a sensitivity of 0.1kg for green biomass yield estimation. Individual samples of Cowpea forage was taken for DM% analysis, which was oven dried at 65^{o}C for 72 hours until constant weight was obtained. Plant height was measured by averaging the natural standing height of ten plants per plot. The main branch number was an average of primary branches on the stem of ten plants per plot. To determine leaf to stem ratio, five plants per plot were taken at random, dried in a paper bag and the leaves then were carefully stripped from the stems. The ratio was obtained by dividing the percentage of leaf by the percentage of stem. The number of pods per plant was calculated as the average of five plants. Number of seeds per pod was calculated as the average of thirty pods. Before measuring grain yield the seed samples were air dried till constant weight obtained. Thousand seed weight was measured from a weight of thousand seeds. Haulm yield was calculated after air dried until constant weight obtained.

Economic analysis

Economic analysis was performed following the CIMMYT partial budget analysis methodology (CIMMYT 1988). Average fertilizer, Cowpea biomass and labour costs for agronomic works were considered for the economic analysis. Following CIMMYT's partial budget analysis methodology, total variable costs (TVC), gross benefit and net benefit were calculated. Total variable cost was calculated as the sum of cost of NPS fertilizer and labour cost of harvesting and transporting of Cowpea. Net benefit was calculated as the difference between gross benefit and the TVC. Cowpea biomass yield was adjusted downwards by 10% assuming that farmers will obtain yields 10% lower than obtained by researchers. Then treatments were listed in order of increasing total costs that vary and dominance analysis was performed where dominated treatments were eliminated and the marginal rate of return (MRR) calculated for the remaining treatments. A treatment that has net benefits that were less than or equal to those of a treatment with lower costs that vary is dominated. A treatment which was non-dominated and having a MRR of greater or equal to 100% and the highest net benefit was considered as economically profitable.

Data analysis

The data collected was subjected to analysis of variance (ANOVA) by using the general linear model (GLM) procedure of Statistical Analysis System (SAS) (2003) version 9.1. When the difference was significant among treatments, LSD (least significant difference) test at 5% probability level was used to locate differences between the treatment means.

RESULTS AND DISCUSSIONS

Plant height (cm)

There was highly significant ($P<0.001$) interaction effect observed between Cowpea varieties and fertilizer usage on plant height (Table 1). The tallest plant height was recorded when Back eye bean Cowpea variety planted with NPS fertilizer. On the contrary, Cowpea variety Kenkety planted with out fertilizer showed the shortest plant height. This could be attributed to the reaction of different cultivars for fertilizer usage. In contrary with the current result relatively the shortest plant height was recorded from all the cultivars at Western Belesa testing site that ranges from 54.75 to 82.62 cm (Surafel et al., 2008). Tesfay et al.

(2018) also reported plant height of 62.75cm for other cowpea varieties at Southern lowlands of Tigray which is relatively lower than the current result. Variations in the plant height of Cowpea cultivars could be attributed to differences in the level of soil fertility and PH, climatic zones of the different study areas and the amount and type of fertilizer utilized.

Table 1. The effect of fertilizer, Variety and their interaction on biomass yield and yield components of Cowpea in 2017 and 2018 irrigation seasons at West Dembia

Fertilizer usage	Cowpea varieties								
	ILRI 9333	ILRI 9334	ILRI 11114	ILRI 12688	ILRI 12713	Kenkety	Back eye bean	IT92KD 258-9	Mean
Plant height (cm)									
With fertilizer	61.43^{fg}	81.45^{cd}	73.83^{cdef}	58.95^{fg}	77.50^{cde}	70.08^{defg}	119.98^{a}	65.55^{efg}	76.10
Without fertilizer	58.85^{fg}	60.22^{fg}	56.07^{g}	81.65^{cd}	63.43^{efg}	41.00^{h}	100.83^{b}	88.59^{bc}	68.83
Mean	60.14	70.84	64.95	70.30	70.47	55.54	110.41	77.07	72.46
CV (%)					12.92				
LSD (5%)					15.03				
LS					***				
Number of branches per plant									
With fertilizer	9.28^{def}	12.80^{a}	10.30^{bcde}	9.60^{def}	6.70^{h}	9.40^{def}	10.80^{bcd}	9.93^{cdef}	9.85
Without fertilizer	8.73^{efg}	8.50^{fg}	7.11^{gh}	11.65^{abc}	2.43^{h}	8.78^{efg}	8.65^{efg}	12.03^{ab}	8.49
Fertilizer usage	**Cowpea varieties**								
	ILRI 9333	**ILRI 9334**	**ILRI 11114**	**ILRI 12688**	**ILRI 12713**	**Kenkety**	**Back eye bean**	**IT92KD 258-9**	**Mean**
Mean	9.01	10.65	8.705	10.63	4.57	9.09	9.73	10.98	9.17
CV (%)					9.27				
LSD (5%)					1.80				
LS					***				
Forage biomass yield (t ha^{-1})									
With fertilizer	30.39^{abc}	34.82^{ab}	31.21^{abc}	29.09^{bcd}	33.36^{ab}	25.05^{cde}	23.22^{de}	34.15^{ab}	30.16
Without fertilizer	16.94^{ef}	17.59^{ef}	11.84^{f}	37.01^{ab}	20.12^{f}	12.04^{f}	12.49^{f}	39.60^{a}	20.95
Mean	23.67	26.21	21.53	33.05	26.74	18.55	17.86	36.88	25.56
CV (%)					17.69				
LSD (5%)					7.02				
LS					***				
Dry matter percent (%)									
With fertilizer	15.56	15.65	16.36	15.77	15.59	17.90	17.02	15.07	16.12
Without fertilizer	16.36	15.83	17.29	17.25	16.61	16.77	17.92	16.91	16.87
Mean	15.96	15.74	16.83	16.51	16.1	17.34	17.47	15.99	16.49
CV (%)					14.01				
LSD (5%)					Ns				
LS					Ns				
Dry matter yield (t ha^{-1})									
With fertilizer	4.68^{cde}	5.22^{abcd}	5.42^{abc}	6.32^{ab}	5.07^{bcd}	4.32^{de}	3.80^{ef}	6.61^{a}	5.18
Without fertilizer	2.76^{fg}	2.73^{fg}	2.09^{g}	4.56^{cde}	3.22^{ef}	1.98^{g}	2.19^{g}	5.02^{bcd}	3.07
Mean	3.72	3.98	3.76	4.56	4.15	3.15	3.00	5.02	3.92
CV (%)					19.31				
LSD (5%)					0.99				
LS					***				
Leaf to stem ratio									
With fertilizer	1.02	0.99	0.94	0.89	1.03	1.03	1.06	1.01	0.99
Without fertilizer	0.98	0.99	0.97	0.87	1.05	1.00	1.02	1.03	0.99
Mean	1.00	0.99	0.96	0.88	1.04	1.02	1.04	1.02	0.99
CV (%)					11.23				
LSD (5%)					Ns				
LS					Ns				
Haulm yield (t ha^{-1})									
With fertilizer	2.30^{bcde}	3.17^{ab}	3.00^{abc}	2.18^{cdef}	2.99^{abc}	2.17^{ef}	1.53^{ef}	2.23^{bcdef}	2.45
Without fertilizer	2.29^{bcde}	2.57^{abcd}	2.32^{bcde}	3.37^{a}	2.95^{abc}	1.25^{f}	1.78^{def}	3.20^{ab}	2.47
Mean	2.30	2.87	2.66	3.37	2.97	1.71	1.66	3.20	2.59
CV (%)					24.98				
LSD (5%)					0.99				
LS					***				

Means within column having different superscript letters are significantly different at ***= P<0.001; ns = non-significant at (P>0.05).
CV = coefficient of variation; ILRI = international livestock research institute; LS = level of significant; LSD = least significant difference.

Number of branches per plant

There was highly significant (P <0.001) interaction among the treatment groups. The highest number of branches was obtained when Cowpea Varity ILRI 9334 planted with NPS fertilizer and Cowpea varieties ILRI 12688 and IT92KD258-9 planted with out fertilizer. This might be due to differences in response of different Cowpea varities for fertilizer. Mean number of brancehs per plant in this study was 9.17. Similarly Tesfaye et al. (2018) reported a mean number of branches per plant of 8.52 for the same genotypes at Southern lowlands of Tigray. In contrary to the current result, Tessema (2018) reported number of branches per plant that ranges from 10-17 at Salayish 1 in Lowlands of Southern Ethiopia. The discrepancy of current result from previous findings could be due to the differences in edaphic factors, environmental temperature and precipitation in different locations. In line with the current result, Tesfay et al. (2018) achieved 8.52 plant heights (cm) for other cowpea varieties at Southern lowlands of Tigray.

Dry matter percent

The two year combined analysis results of the experiment at West Dembia indicated that there was no any significant (P>0.05) interaction observed with the cowpea varieties and fertilizer usage (Table 1). Mean dry matter percent was 16.49 for all the cowpea varieties.

Green biomass and dry matter yield (t ha^{-1})

There was highly significant (P<0.001) interaction observed among Cowpea varieties and fertilizer usage in green biomass and dry matter yield (t ha^{-1}) (Table 1). Cowpea varieties ILRI 9334, ILRI 11114 and IT92KD258-9 when planted with NPS fertilizer produced significantly (P <0.001) highest green biomass and dry matter yield (t ha^{-1}). This is due to positive response of the varieties for the NPS fertilizer in producing green biomass and dry matter yield as well. Even though variety ILRI 12688 with NPS fertilizer produced significantly lower green biomass due its higher dry matter percentage it also gave significantly higher (P<0.001) dry matter yield (t ha^{-1}). Compared to the current result obtained, relatively lower dry matter yield (1.75 to 3.06 t/ha) was observed by different cultivars at West Belessa (Surafel et al., 2008). The mean dry matter yield of Cowpea varieties in this study was relatively lower than the reports of Tesfay et al. (2018) who reported 6.54t ha^{-1}yr^{-1} for Cowpea varieties. This could be attributed to the differences in varieties used, environmental temperature and precipitation in different locations.

Leaf to stem ratio

There was no significant (P>0.05) interaction observed with the Cowpea varieties and fertilizer usage in leaf to stem ratio across years (Table 2). The mean leaf to stem ratio was 0.99 which agrees with the finding of Tesfaye et al. (2018) who reported leaf to stem ratio that ranges from 0.75 to 1.10 for black eye bean, ILRI 9333, ILRI 9334 and Temesegen cowpea varieties at Southern lowlands of Tigray.

Haulm yield (t ha^{-1})

The result revealed that there was highly significant (p<0.001) interaction among Cowpea varieties and fertilizer usages on cowpea haulm production (Table 1). The highest haulm yield was recorded from cowpea variety ILRI 9334, ILRI 11114 and ILRI 12713 when planted with fertilizer and when ILRI 9334, ILRI 12688, ILRI 12713 and IT92KD258-9 cowpea varities planted with out fertilizer. This indicates that different cowpea varieties reacts differntly for fertilizer usage in producing haulm yield (Tesfay et al., 2018).

Table 2. Mean grain yield and yield components of Cow pea varieties tested in 2017 and 2018 irrigation seasons at West Dembia

Treatment	Number of pods per plant	Number of seeds per pod	Grain yield (kg ha^{-1})	Thousand seed weight (g)
ILRI 9333	37.98^{cde}	11.22^{d}	2261.10^{b}	156.64^{d}
ILRI 9334	32.15^{de}	12.05^{cd}	898.60^{d}	88.63^{g}
ILRI 11114	53.75^{b}	13.14^{bc}	2289.00^{b}	136.36^{f}
ILRI 12688	47.35^{bc}	13.54^{b}	2157.90^{b}	177.99^{b}
ILRI 12713	42.50^{bcd}	11.91^{cd}	1458.10^{c}	159.61^{cd}
Kenkety	23.33^{e}	12.90^{bc}	2335.10^{ab}	144.71^{e}
Black eye bean	33.20^{cde}	9.30^{e}	2168.10^{b}	211.75^{a}
IT92KD258-9	69.60^{a}	15.27^{a}	2796.30^{a}	165.98^{e}
Mean	42.48	12.42	2045.53	155.21
CV (%)	24.68	11.29	22.71	4.41
LSD (5%)	14.87	1.41	468.83	6.91
LS	***	***	***	***

Means within column having different superscript letters are significantly different at ***= P<0.001.
CV = coefficient of variation; ILRI = international livestock research institute; LS = level of significant; LSD = least significant difference.

Number of pods per plant and number of seeds per pod

There was no any significant (P> 0.05) interaction effect observed between Cowpea varieties and fertilizer usage in producing number of pods per plant and number of seeds per pod (Table 2). The result revealed that there was highly significant difference between cowpea varieties on number of pods per plant and number of seeds per pod production. The highest number of pods per plant and number of seeds per pod was obtained from Cowpea variety IT92KD258-9. This could be attributed to the genetic differences by the different cultivars and variation in the production environment and management practices applied on the cultivars. The mean number of pods per plant and number of seeds per pod was relatively higher than the result achieved by Tekle (2014) at Alduba, Southern Ethiopia. This might be due to the genetic differences by the different cultivars and suitability of the production environment for the cultivars.

Grain yield (kg ha^{-1})

The combined analysis of variance result showed that there was a significant (P<0.001) difference between Cowpea genotypes tested in grain yield (Table 2). Among the genotypes tested Kenkety and IT92KD258-9 recorded significantly (P<0.001) higher grain yield than the rest of varieties. This might be due to the genetic differences of the different cultivars. The mean grain yield of the current study was in contrary with the pervious results of Surafel et al. (2008) for all the cultivars tested at Western Belesa, which ranges from 2900 to 3900 kg ha^{-1}, respectively. This could be due to the agro ecological and edaphic differences and Cowpea varieties used within the study areas.

Thousand seed weight (g)

The mean combined analysis result of thousand seed weight for the different Cowpea varieties tested is given in Table 2. Back eye bean cowpea variety recorded significantly (P<0.001) higher thousand seed weight compared to other cultivars. This was due to the seed size and amount of endosperm contained related to the genetic difference among the genotypes.

Partial budget analysis

The result of partial budget analysis was shown in Table 3. Financial profitability is the ultimate measure to recommend a technology. Any technology that is agronomically feasible and is beneficial for soil improvement would not be attractive to farmers unless it is financially profitable.

Table 3. Economic analysis for the Cowpea biomass yield produced at West Dembia in 2017 and 2018 irrigation seasons

Treatment	CPDMY (t ha^{-1})	ACPBY (t ha^{-1})	TGFBFCPH (ETB)	TCTV (ETB ha^{-1})	NB (ETB ha^{-1})	Dominance	MRR (%)
Kenkety without fertilizer	1.98	1.78	2,670.00	304.84	2,365.16		
ILRI 11114 without fertilizer	2.09	1.88	2,820.00	321.97	2,498.03		775.66
Black eye bean without fertilizer	2.19	1.97	2,955.00	337.38	2,617.62		776.05
ILRI 9334 without fertilizer	2.73	2.46	3,690.00	421.30	3,268.70	D	
ILRI 9333 without fertilizer	2.76	2.48	3,720.00	424.30	3,295.70		900.00
ILRI 12713 without fertilizer	3.22	2.90	4,350.00	496.65	3,853.35		770.77
ILRI 12688 without fertilizer	4.56	4.10	6,150.00	702.16	5,447.84		775.87
IT92KD258-9 without fertilizer	5.02	4.52	6,780.00	774.09	6,005.91		775.85
Black eye bean with fertilizer	3.80	3.42	5,130.00	2,025.71	3,104.29	D	
Kenkety with fertilizer	4.32	3.89	5,835.00	2,106.20	3,728.80		775.89
ILRI 9333 with fertilizer	4.68	4.21	6,315.00	2,161.00	4,154.00		775.91
ILRI 12713 with fertilizer	5.07	4.56	6,840.00	2,220.94	4,619.06		775.88
ILRI 9334 with fertilizer	5.22	4.70	7,050.00	2,244.92	4,805.08		775.73
ILRI 11114 with fertilizer	5.42	4.88	7,320.00	2,275.74	5,044.26		776.05
ILRI 12688 with fertilizer	6.32	5.69	8,535.00	2,414.46	6,120.54		775.87
IT92KD258-9 with fertilizer	6.61	5.95	8,925.00	2,458.99	6,466.01		775.81

ACPBY = adjusted Cowpea biomass yield (t ha^{-1}); CPDMY = Cowpea dry matter yield (t ha^{-1}); D = dominance; ETB = Ethiopian birr; MRR = marginal rate of return; NB = Net benefit (ETB ha^{-1}); TCTV = total cost that vary (ETB ha^{-1}); TGFBFCP = total gross field benefit from Cowpea hay.

The partial budget analysis showed that variety ILRI 9333, ILRI 11114, ILRI 12688, ILRI 12713 and IT92KD258-9 when planted with and with out fertilizer; when variety ILRI-9334 and Kenkety planted only with fertilizer and also variety back eye bean when planted with out fertilizer was found economically profitable as it gives a rate of return above the 100% acceptable rate of return. In the current study, by the use of these varieties either with or without fertilizer farmers in the study area will be able to gain from 7.76 to 9.00 ETB for each 1.00 ETB investment on inputs, which implies a very high increase in farmers' income with a simple improvement in soil fertility through nitrogen fixation. In most cases the economic analysis result disagrees with the agronomic result. This financial benefit is in addition to the benefit in terms of soil fertility improvement which could not be directly quantified in terms of monetary value.

CONCLUSIONS

The results of this study indicated that Cowpea varieties ILRI 9334, ILRI 11114 and IT92KD258-9 when planted with 100 kg ha^{-1} NPS fertilizer produced better forage green biomass and dry matter yield (t ha^{-1}) compared to the other varieties when planted with and without fertilizer. Among the genotypes tested, Kenkety and IT92KD258-9 varieties were produced relatively higher grain yield than the rest of genotypes consistently when planted with and without fertilizer. With respect to haulm yield, from the varieties used ILRI 9334, ILRI 11114 and ILRI 12713 when planted with fertilizer and when ILRI 9334, ILRI 12688, ILRI 12713 and IT92KD258-9 Cowpea varities planted with out fertilizer can produced better yield after grain harvest. From this study result it can be concluded that Cowpea varieties ILRI 9334, ILRI 11114, ILRI 12688 and IT92KD258-9 with 100 kg ha^{-1} NPS fertilizer should be used for better dry matter yield production. Moreover, it was concluded that Cowpea varieties ILRI 9333, ILRI 11114, ILRI 12688, ILRI 12713 and IT92KD258-9 when planted with and with out fertilizer and when variety ILRI 9334 and Kenkety planted only with fertilizer was found economically profitable. Hence, according to the results of this study use of Cowpea varieties ILRI 9334, ILRI 11114, ILRI 12688 and IT92KD258-9 were found biologically efficient and potentially profitable for a better biomass production.

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