PROFITABILITY ANALYSIS OF TWO FORAGE COWPEA VARIETIES AS INFLUENCED BY IRRIGATION INTERVALS AND PHOSPHORUS APPLICATION RATES IN ZARIA-NIGERIA

*[1]Bala, A.G., [2]Hassan, M.R., [3]Tanko, R.J., [3]Amodu, J.T., [2]Bello, S.S., [3]Ishiaku, Y.M and [4]Mijinyawa, M.A.

[1]*Division of Agricultural Colleges, College of Agriculture and Animal Science, Ahmadu Bello University, Mando, Kaduna State, Nigeria.*

[2]*Department of Animal Science, Ahmadu Bello University, Zaria, Nigeria.*

[3]*National Animal Production Research Institute, Shika, Ahmadu Bello University, Zaria, Nigeria.*

[4]*Sa'adatu Rimi College of Education, Kumbotso, Kano State.*

*Corresponding Author: balaaminu@gmail.com; agbala@abu.edu.ng ; +2348068928548

Abstract

An experiment was conducted to investigate the profitability of production of two forage cowpea varieties (Sampea 14 and 15) under varying irrigation intervals and phosphorus (P) application rates in Zaria-Nigeria. The experiment was laid out in a 2×3×3 factorial arrangement in a split plot design with three replicates. The treatments consist of combinations of two cowpea varieties, three irrigation intervals and three P levels, respectively. Results revealed that an operating profit margin analysis (OPMA) of 0.6% per 100kg bag of cowpea grains was realized for the two cowpea varieties across all the treatment combinations. An OPMA of 2.17% was realized for the forage of the two cowpea varieties across the treatment combinations except for Sampea 14 harvested from the use of irrigation interval of 5 and 10 days in combination with 20 and 40 kg P/h and Sampea 15 harvested from the use of irrigation interval of 15 days in combination with 40 kg P/ha. The highest OPMA (2.68%) was realized with Sampea 14 harvested from the use of irrigation interval of 5 days in combination with 20 kg P/ha, followed by Sampea 14 (1.30% OPMA) harvested from the use of irrigation interval of 10 days in combination with 40 kg P/ha while Sampea 15 harvested from the use of irrigation interval of 15 days in combination with 40 kg P/ha recorded the least OPMA (0.73%). Therefore, it was concluded that irrigation interval of 10 days in combination with 20 kg P/h could increase forage yield of Sampea 14 by more than 200% and grain yield of the two cowpea varieties by 60%. This will help to better the living standard of farmers under smallholder crop-livestock production system in Nigeria.

Keywords: Forage, irrigation, phosphorus, profitability, Sampea.

Introduction

Feeding of forage legumes has been found easily adoptable, but farmers do not pay particular attention to the planting of pure forage legume stands, rather greater emphasis is on the cultivation of other crops. In an integrated crop-livestock farming systems, planting of dual-purpose legumes is gaining popularity. Apart from its grains that yield immediate economic returns, its fodder is also a good dry season feed supplement to livestock. In the savannas of West Africa, cowpea is a valuable source of livestock fodder making the dual purpose cultivars very attractive to farmers (Kamara *et al.*, 2012). Profitability levels of cowpea grains or fodder vary depending on the quality of the agronomic practices employed. Among these, seed varieties, phosphorus (P) application rates and irrigation frequency are powerful management tools whereby a grower can strongly influence crop productivity and profitability during the dry season. Cowpea can produce good yields of high quality dry matter forage/haulm of up to 10t/ha under irrigation (Lemma *et al.*, 2009) compared to the world average yield of 0.5t/ha (Madamba *et al.*, 2006) and dry fodder yield of 0.23t/ha by Sampea 14 cowpea variety (Bala *et al.*, 2018) under rain fed conditions. Considering the good qualities of this legume crop in the tropical savanna, there is need to investigate the suitable irrigation interval and P fertilization levels that could meet up with profit demands of cowpea famers and offer better opportunity for grains and forage yields to support livestock production during the critical period of the year. The objective of this study was to investigate the profitability analysis of two forage cowpea varieties as influenced by irrigation intervals and P application rates.

Materials and Methods

The experiment was conducted at the irrigation site of the Institute for Agricultural Research (IAR) Samaru-Zaria and laid out in a 2×3×3 factorial arrangement in a split plot design with three replicates. The treatments consist of combinations two cowpea varieties (SAMPEA 14 and 15), three irrigation intervals (5, 10 and 15 days) and three phosphorus application rates (0, 20 and 40 kg/ha), respectively. Variety and irrigation interval were assigned as the main plots, while the phosphorus application rates was placed in the sub-plots. There were a total of 54 net plots measuring $4m^2$ with 1m inter-row path and watering channels.Irrigation treatment commenced at 3 weeks after sowing. The dry forage yields (cowpea haulms) and grain yield were obtained using a standard procedure of Tarawali *et al*. (1995).The total expenditure used in the production was recorded as the variable cost. The costs for cowpea yields per kilogram were estimated based on the current prices at grains and fodder markets. The financial benefit derived from it was estimated using the farm budgeting tools as follows;

a. Operating profit margin analysis (OPMA) in % = Operating Income (OI) /Total Revenue (TR) × 100
b. Total revenue (TR) in ₦/ha = is the product of average price of cowpea grain and haulm yield.
c. Operating income (OI) = the potential yield (grain and forage/haulm).

Data collected were analyzed using the above farm budgeting tools.

Results and Discussion

The profitability of two forage cowpea varieties as influenced by irrigation intervals and phosphorus (P) application rates is shown in Table 1. The price/kg of cowpea grains (₦166, 00) and cowpea haulm (₦46, 00) was used in the analysis. Profitability analysis is a common tool used by many managers of different enterprises to make decisions on whether to participate in the enterprise or not. It gives an idea of how much a farmer makes on each naira of sales. Results revealed that an operating profit margin analysis (OPMA) of 0.6% for cowpea grains was realized for the two cowpea varieties across all the treatment combinations. The percentage OPMA implies that farmers will earn extra income of 0.6% per 100kg bag of cowpea grains irrespective of the variety, irrigation intervals and the level of P used. The low OPMA could be due to high costs of irrigation and inputs. In crop production most of the factors that affect profitability are the production costs, fertilizer usage, seed variety, labour and land rent (Ibro, 2008). Studies by Abubakar, (2006) and Haruna *et al.* (2009) conducted on profitability of different varieties of cowpea grains in Zamfara and Gombe reported a remarkable profit gain among farmers.

Similarly, an OPMA of 2.17% of cowpea forage/haulms was realized for the two cowpea varieties across all the treatment combinations except for Sampea 14 harvested from the use of irrigation interval of 5 and 10 days in combination with 20 and 40 kg P/ha and Sampea 15 harvested from the use of irrigation interval of 15 days in combination with 40 kg P/ha. These results showed that a corresponding gain of more than 200% (2.17% per 100kg bag of cowpea forage/ haulm) would be realized by the farmers from sales of cowpea forage/haulms irrespective of cowpea variety used, irrigation intervals and the level of P. This is an added bonus, aside the final grain yield at harvest; which, could more than compensate for the little grain yield gained (Igbala *et al*., 2018). This is in conformity with Singh *et al.* (1997) who reported that farmers who cut and store cowpea fodder, for subsequent sale at the peak of the dry season, have been found to obtain as much as 25% of their annual income by this means.

The highest OPMA (2.68%) was realized with Sampea 14 harvested from the use of irrigation interval of 5 days in combination with 20 kg P/ha which was followed by same cowpea variety (1.30% OPMA) harvested from the use of irrigation interval of 10 days in combination with 40 kg P/ha. The treatment combinations could increase forage yield of Sampea 14 by more than 200% and grain yield of the two cowpea varieties by 60 %. High or increasing operating margin is preferred because the farmer earned more per naira of sales. The lowest OPMA (0.73%) was generated by Sampea 15 when it was harvested from the use of irrigation interval of 15 days in combination with 40 kg P/ha (Figure 1). The low OPMA might be due to reaction of cowpea to moisture stress at longer irrigation intervals, leading to reduction in yields and consequently the revenue generation. It was reported that shorter irrigation intervals favoured excessive

yield (Etissa *et al.*, 2014). Therefore, production of forage cowpea varieties under varying irrigation and phosphorus rates was found to be profitable. The study has further shown that, substantial financial gains can be made by the smallholder crop-livestock farmers who are in dare need of funds to meet up with farms operational activities at the peak of the dry season.

Conclusion

Based on the results obtained in this study, it could be concluded that irrigation interval of 10 days in combination with 20 kg P/ha could increase forage yield of Sampea 14 by more than 200% and grain yield of the two cowpea varieties by 60%. Consequently, this will improve the living standard of farmers under smallholder crop-livestock production system in Nigeria.

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Table 1: Profitability analysis of two forage cowpea varieties (V) as influenced by irrigation intervals (I) and phosphorus application rates (P).

Treatments	Yield(kg/ha)		Gross revenue(₦/ha)		Operating profit margin analysis (%)	
combination	Grain	Haulm	Grain	Haulm	Grain	Haulm
$V_1I_1P_1$	3630	700	602,580	32,200	0.60	2.17
$V_1I_1P_2$	4550	1350	755,300	62,100	0.60	2.17
$V_1I_1P_3$	2930	0570	486,380	26,220	0.60	2.17
$V_2I_1P_1$	3790	1320	629,140	60,720	0.60	2.17
$V_2I_1P_2$	4590	2290	761,940	105,340	0.60	2.17
$V_2I_1P_3$	3890	960	645,740	44,160	0.60	2.17
$V_1I_2P_1$	3630	1320	602,580	60,720	0.60	2.17
$V_1I_2P_2$	1480	3700	245,680	138,000	0.60	**2.68**
$V_1I_2P_3$	3200	1230	531,200	56,580	0.60	2.17
$V_2I_2P_1$	4120	2600	683,920	119,600	0.60	**1.30**
$V_2I_2P_2$	3350	1000	556,100	46,000	0.60	2.17
$V_2I_2P_3$	5450	2300	904,700	105,800	0.60	2.17
$V_1I_3P_1$	1870	390	310,420	17,940	0.60	2.17
$V_1I_3P_2$	1960	800	325,360	36,800	0.60	2.17
$V_1I_3P_3$	2000	680	332,000	92,000	0.60	**0.73**
$V_2I_3P_1$	3380	2300	561,080	105,799	0.60	2.17
$V_2I_3P_2$	1800	700	298,800	32,200	0.60	2.17
$V_2I_3P_3$	1410	1000	234,060	46,000	0.60	2.17

V_1 = Sampea 14, V_2 = Sampea 15, I_1 = at 5 days I_2 = at 10 days I_3 = at 15 days, P_1 = at 0kgP/ha, P_2 = at 20kgP/ha, P_3 = at 40kgP/ha, Price/kg of cowpea grain = ₦166:00, Price/kg of cowpea haulm = ₦46:00,

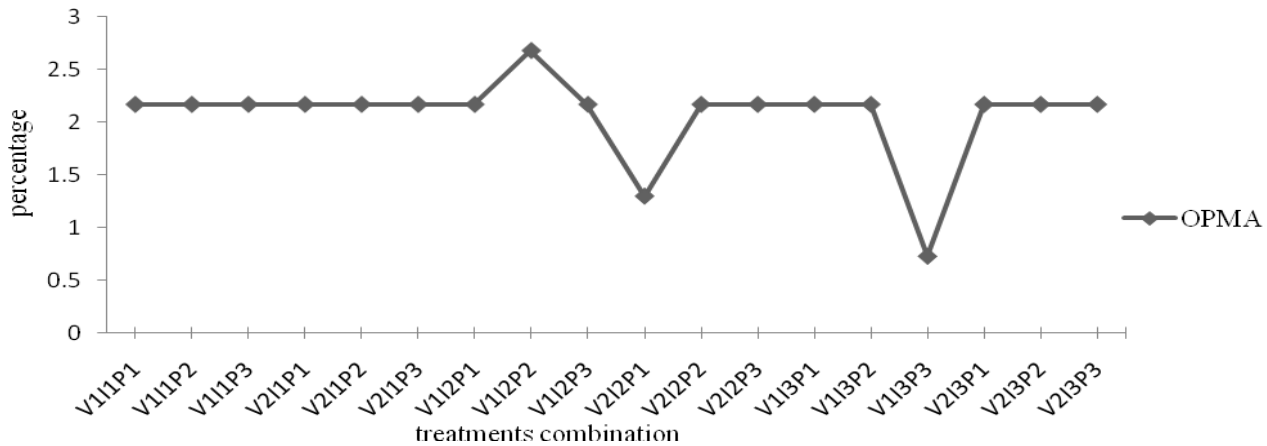

Figure 1: Trend of operating profit margin analysis of two varieties of cowpea as influenced by irrigation intervals and phosphorus application rates.