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Economics of Faba Bean Production and Marketing in Northern Sudan

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Abstract

Faba bean is the most important food legume in Sudan. It makes up a major part of the daily diet for the population. Moreover, it plays an important role in sustaining the productivity of the farming systems through the fixation of atmospheric nitrogen.
The northern region of Sudan is considered as one of the main supplier of faba bean in the country. The crop is commonly produced under pump irrigation from the River Nile. The production and marketing of the crop in the region has faced manifold problems namely low level of productivity, high high cost of production, fluctuation of prices, inadequate market credit and weak marketing arrangements. This paper describes the study of the economic aspects of production and marketing of faba bean in the region. The research revealed that the irrigation water cost constituted 26% of the total variable cost for faba bean production, while the transportation costs amounted 64% of the total marketing cost. The actual productivity of faba bean in the region was found very low, 450 kg feddan-1 (ca. 1070 kg ha-1). The yield gab with the potential yield obtained by ICARDA in this region (International Centre for Agricultural Research in the Dry Areas) amounts 50%. The study detected further that the most important factors that significantly affect the productivity and the marketable surplus were the number of irrigation events, type of scheme, source of irrigation, seed rate, credit availability, farmers' educational level, the reserved amounts for household consumption and the produced quantities of the crop. The study concluded that faba bean production contribute significantly to farm sustainability and alleviates malnutrition in the region. However, the actual production and marketing constraints restrict the sustainability of this important crop. So, the cooperation between international organisations and governmental institutions should tackle the hindrances of faba bean production and establish adequate market infrastructures in the region.

Introduction

Faba bean production is concentrated in the North of Sudan; production takes place under farming system of small private pump schemes and some big public schemes. Faba bean is the most important legume in Sudan; it constitutes the main dish on the breakfast and dinner tables for large sector of population, and consumed by all income groups. The average per capita consumption was found to be 2.25 kg/month in the urban area, it is considered among the most important annually produced crops with respect to its share in area and farm income in the River Nile State (Yousif, 1988).

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Faba bean production and marketing in the River Nile State is faced by many problems, *first,* the low level and fluctuations of yield. Constraints that contribute to the low level and fluctuations of faba bean productivity include poor cultural practices used by farmers, lack of high yielding

cultivars, stress inflicted by the harsh environmental conditions, particularly high temperature, diseases, insects, pests, weeds and intrinsic factors pertaining to the sensitivity of the species to sudden changes in climatic conditions (Solh, 1995).

Second, Irrigation water is the most important constraint for agricultural production in the northern Sudan. As a result of high cost of pumping water from the River Nile, irrigation is costly, and justifies the strict water allocation among different crops grown (Salih et al, 1996).

Third, the fluctuation of faba been price, is one of the main problems that faced its marketing. Moreover, the importation of faba bean from Egypt at the time of harvest had resulted in drastic reduction in the price of the crop from 14000 SD/sack to about 10000 SD/sack in 2003(Elsir et al, 2003). .

Fourth, the inadequate credit and the weak infrastructure and the remoteness of the production region prevent adequate interaction with the rest of the country. This has forced small farmers to sell their product in the local market at lower prices. Therefore, the traders, whom they provide the credit, buy farmer's production in low prices and sell it to consumers in high prices, so they earn more benefits while farmers are coughing in a double throat from the constrained income (Ahmed, 1995).

Accordingly, the main objective of this study is to explore the problems, of faba bean production and marketing in the River Nile State in order to analyse the factors affecting these constraints. More specifically the study aims to evaluate the factors affecting the performance of faba bean production assess the cost of production, investigate the affect of credit and marketing system, and to investigate the pattern of the price movement of the crop.

Materials and Methods

This study depends mainly on primary data from the study area, beside secondary data from relevant official sources. The method selected for primary data collection was direct personal interviewing of the sample respondents by using structural questionnaires. The primary data collected in 2002/03 season included the information about farmers' socio-economic characteristic such as sex, marital status, educational level, family size, family sharing production, farm size, share of farmer, land type, scheme type, source of irrigation, land tenure, other information collected include the main winter crops (yield area), cost and return of production, source of finance, marketing cost, marketing channel, marketing price, and marketing cost.

Secondary data which was collected from relevant institutional sources such as River Nile State Ministry of Agriculture and Irrigation, Federal Ministry of Agriculture and Forestry, Department of Planning and Agricultural Economics, Arab Organization for Agricultural and Development (AOAD), Agricultural Research Corporation (ARC), Khartoum and Gezira Universities and Bank of Sudan.

As precision could be achieved, stratified random sampling based on its convenience and flexibilities were applied to Eddamer district where the population was divided into two strata. This was based on the geographical and administrative divisions represented by West and East of the River Nile within Eddamer district. Each stratum was then subdivided according to the cultivated area in Eddamer district as a method of data collection, because it saves time and money especially if larger areas are to be covered. It also enables the researcher to use a wide range of selection through the sample unit.

A total number of 60 farmers out of 1200 farmers (about 5%) were randomly selected and interviewed from the East and West Nile banks of Eddamer district using field survey questionnaire assuming that this sample size is representative to the population. 66.7 % and 33.3 % of the total sample were selected from West and East Nile banks of Eddamer district respectively. The share of west Nile district in the sample was the largest due to the vast

cultivated area there in 2003, and more consideration has been given to faba bean, wheat, spices as main winter season crops in River Nile State.

To achieve stated objectives descriptive statistical and regression analysis using Cobb-Douglas production function were used. In the descriptive part of the analysis frequency distribution, graphical and statistical analysis was used. Cost/benefit analysis was also used to assess the cost of production and the main cost items, to examine the profitability of faba bean. Production function was estimated through Cobb-Douglas production function. Different forms were tried to choose the best representative model. Cobb-Douglas production function analysis using (OLS) regression was used to assess the effect of the hypothesized independent variables on output of the faba bean as dependent variable.

Two types of constraints were noticed in the study area, first, the lack of infrastructure made the movement over the study area difficult, and the unavailability of transportation (except certain day(s) per week for some parts of the study area), second, some farmers were ignorant about the research work, and hence, they required more time to obtain the right information from them, moreover, some of them thought that the research work end to take taxes so they refused to be interviewed. Furthermore, many farmers reported that a lot of research work had been done in their areas, without tangible returns to them.

Results and Discussion

Starting with the socioeconomic indicators in the study area, the respondent's educational level found to be 83.3% of the farmers are literate and received formal education ranging from basic school (58%) to higher secondary school (25%), and about 16.7 % are illiterate.

All farmers in the sample are males and 86.7% of them were single while about 11.7% were married and only 1.7% of them were divorced. Farmer family members are considered as an important source of labor force in study area. The family size ranged between 1 and 22 members, with average family size of 5 persons and 11.7% of the families are small (less or equal 3 persons), about 28.3% are medium (between 4-6 members), and about 46.7% of the families are large (between 7-22 members).

The size of the agricultural holding is small in the study area. As figure1 shows; about 11.7% of the farms are less than 5 feddans, the main reason behind the small farm size is the land fragmentation under private and cooperative schemes while for public schemes the average farm size ranges between 5-10 feddans with about 50% of the holdings lie in this range, 21.7% of the farms between 11-15 feddans, 5% of the farms ranged between 16-20 feddans, and about 11.6 % of the farms are above 20 feddans.

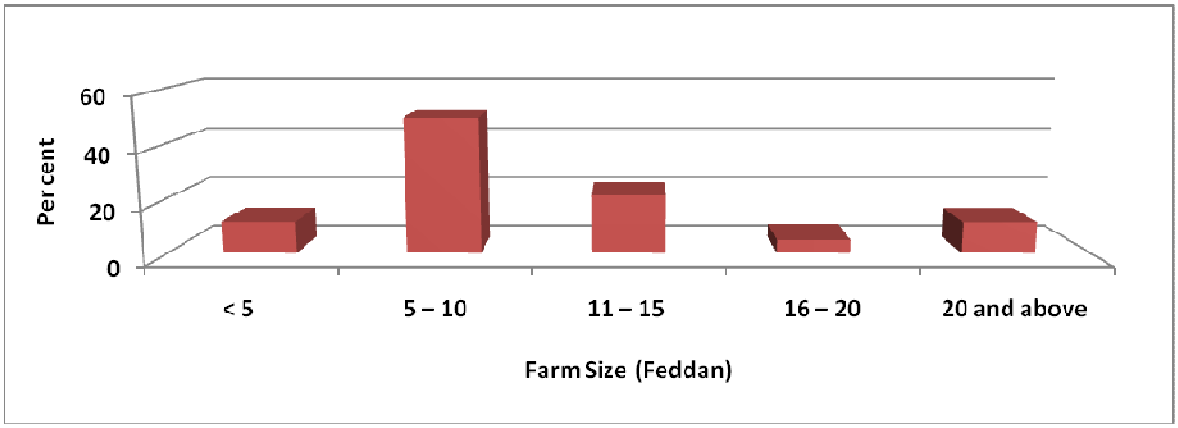

Figure1. Farm size in the study area 2003.

With respect to land tenure in the study area, the study found that 28.3% of the land tenure is privately owned by individuals, 30% is shared, while 41.7% is rented either from private persons or from the government.

Production Cost

Faba bean is produced under irrigated pump system in Northern Sudan, the variable cost of production consists of two types, explicit and implicit cost, the explicit one includes labor force, machinery services which required fuel, annual maintenance, spare parts and operator(s) for the private and cooperative scheme, and water fixed rate in public schemes. The implicit cost, of course not value paid, it is done by the family members and relatives share in production process. The survey revealed the following items of production cost as shown in figur2.

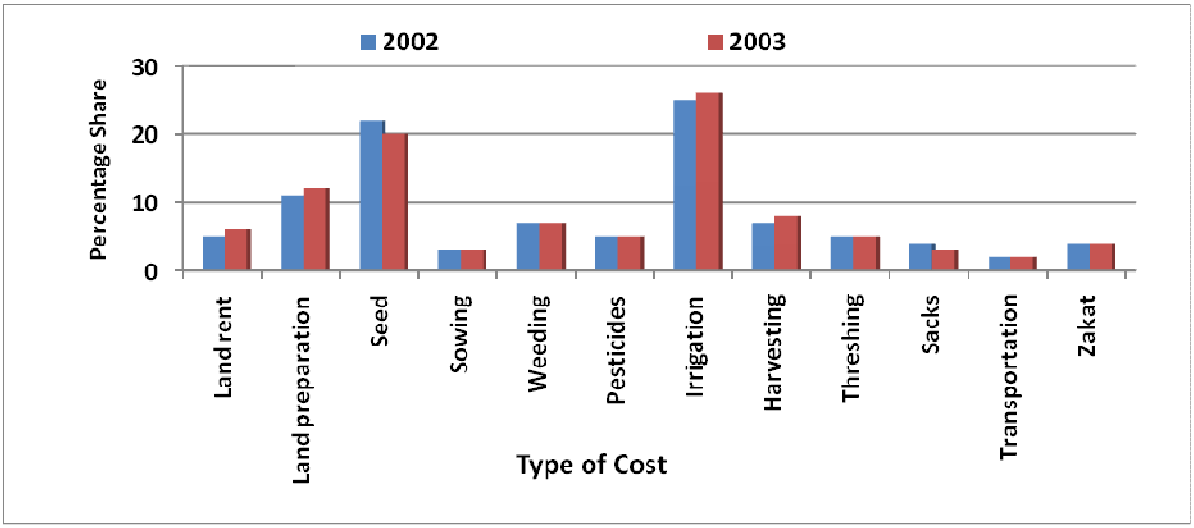

Figure2. The % share of faba bean production's variable costs in RNS 2002 and 2003.

Irrigation and seeding showed the highest share in the two years, Faba bean growers in the private and cooperative schemes bear the cost of fuel used, oil, spare part, operator …etc, on the other hand, growers in the public schemes pay a fixed rate for irrigation. The study found that the share of irrigation in the total cost is 25% and 26% two seasons respectively. The average cost of irrigation for faba bean was to be the highest than the overall average cost, and that was conformable to most studies in northern Sudan. The cost of irrigation by underground water is usually more than the irrigation water from the River Nile due to the high operational costs as well as the additional number of irrigation needed.

Traditionally, farmers in Northern Sudan retain their seeds from the previous harvest. Due to this reason and the sustainable shortage of improved seeds, surveyed farmers revealed that they rely on their seeds stock which is about 50kg/feddans with a cost of about SD 10490 in 2002 and SD 9690 in 2003, and a share 22% and 20% to total production cost in the two years respectively.

Total Returns

The gross returns per feddans were found to be SD 53062, while the average gross margin per feddan was found to be SD 4752.

The profitability of faba bean which has an important consideration in the producer choice is measured through the Coefficient of Private Profitability (CPP).

$$CPP = \frac{TR \text{ / fed at farm gate price}}{\text{TC/fed at farm gate}} = \frac{53062}{48310} = 1.10$$

Where:

TR is the total revenue, and TC is the total costs. If the CPP is less than 1, then it's unprofitable to produce faba baen at the present productivity level. Accordingly in the study area growing faba bean is a profitable activity.

The break even yield is known as the yield that just covers the production cost. It is equal to the total cost of production per feddan divided to the price per sack in case of faba bean.

$$\textit{Breakeven point} = \frac{\text{Total cost production /feddan}}{\text{Price per unit of yield}} = \frac{48310}{10829} = 4.5 \text{ sack/feddans}$$

According to this result, the average yield of faba bean per feddan in the study area was more by 0.4 sack per feddan (4.9 – 4.5 = 0.4 sack per feddan) indicating that the output per feddan for the crop covered its actual cost of production in 2002 and 2003.

Regression Results

Heady and Dillon (1961) regression model which based on Cobb-Douglas production function has been adopted, using faba bean data for the year 2003. The model considered the yield per feddan as a dependent variable and number of irrigations (per season), seed rate (kg /feddan), credit (SD/feddan), type of project, and source of irrigation as independent variables using dummy variables for type of project and source of irrigation. All the variables have the expected signs with their coefficients passing the t-test at different significance level. The specified model gave, R-square of 0.88 which means that 88% of the variation in faba bean yield is explained by the independent variables in the model. Details are shown as follows in table1.

Table1. Factors affecting the yield of faba bean in the study area in the year 2003.

Variables	Coefficients	Standard Errors	T-values	Level of Significance
Intercept	-3.291	1.294	-2.543	*
Number of irrigations	0.920	0.247	3.721	**
Seed rate (kg)	1.354	0.632	2.144	*
Credit (SD)	0.178	0.040	4.444	**
Type of scheme	0.868	0.155	5.597	**
Source of irrigation	1.557	0.396	3.936	**

R-square = 0.88
Adjusted R-square = 0.80
F-value = 11.78
** = Significant at 95% level of probability.
* = Significant at 90% level of probability.

The number of irrigation has got coefficient of 0.92 at 95% level of significance. Which means a relative increase of 1 % in the number of irrigations will cause a relative increase of 0.92% in yield of faba bean. This is generally conformable to some studies in the region which revealed that the most agricultural constraints in Northern Sudan is irrigation, like Saeed (1988), Elfeil (1993), Alawad (1994), Solh (1995), and Mohamed (2000).

The irrigation shortage may be attributed to inadequate supply of irrigation inputs such as fuel, spare parts, labor, and their unavailability in right time and with acceptable prices for public and private sector. This problem is more associated with crop production in high terrace land where lifting underground water is extremely costly when compared to the cost in low terrace land due to the type of water and soil conditions. This may justify why farmers apply less number of irrigations than recommended, moreover, their poor financial resources and unavailability of formal credit to purchase irrigation inputs even when these inputs are available.

The seed rate (kg/feddan) with coefficients of 1.35 at 90% level of significance is an important factor affecting faba bean yield in the study area. The cost of seeding was ranked as a second factor after irrigation according to their percentage share in the production cost in 2003. The high cost of faba bean seeds attributed to the fact that the price of the crop seeds is very expensive

during the sowing time, and this also justify why farmers might apply low seed rate, and infected seeds, moreover the absence of extension services may also be an important factor.
Credit coefficient was 0.18 at 95% level of significance. This can be justified on bases that the majority of the farmers in Northern Sudan depend on the seasonal credit, which is not enough to supply the total needed inputs for production which is conformable with Mohammed (1982), Saeed (1988), Khalafalla (1990), Ijemi (1994), and Faki et al (2003),
The type of project coefficient was 0.86 at 95% level of significance, confirming the principle of economics of scale.
The source of irrigation coefficient was 1.56 at 95% level of significance. The Nile water resulted more output compared to the underground water, and this is attributed to the silt, clay and other favorable nutrients in the Nile water, while underground water contains unfavorable nutrients like saline and sodic soils.

Marketing of faba bean

According to Khalafalla (1990) the marketing of faba bean is the responsibility of the farmers who undertake it individually. The main market is Zeidab market. The faba bean price determined actually by the merchants who lower it after harvest and raise it before sowing. Inadequate credit and marketing arrangements are the most important constraints facing the production of faba bean.

Marketing Costs

Transportation of the crop was found to have the biggest share (64%) in the marketing costs, followed by store pest control with 31% as shown in figure3.

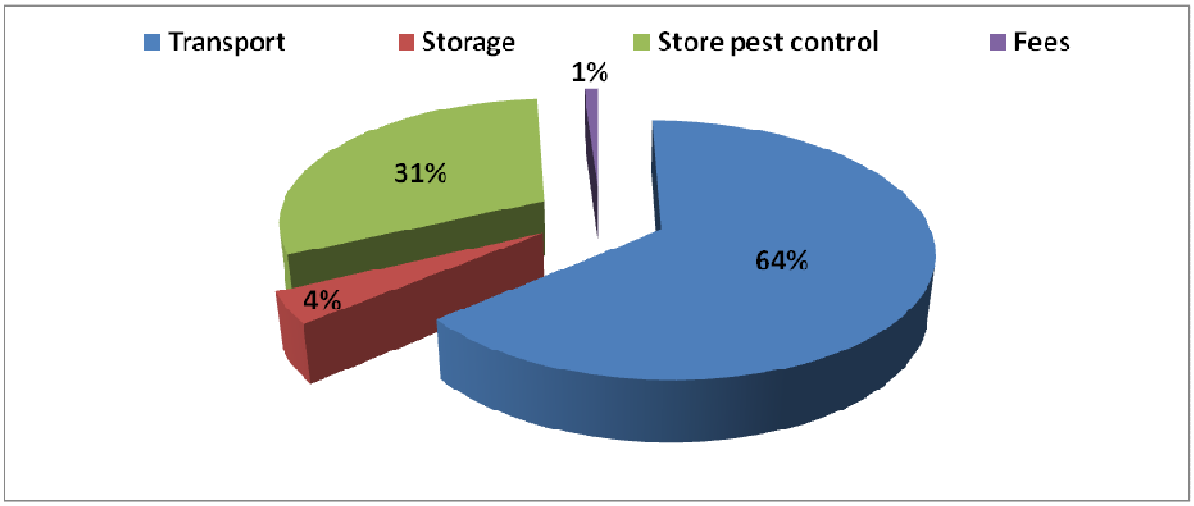

Figure3. The share of faba bean marketing cost in Eddamer District

These kinds of costs are applied the produced quantities after subtracting the reserved quantity as seeds and household consumption, while about 50% of farmers in the study area found to reserve their seeds for the next season from their own production.

Regression Results

The amount of faba bean available for marketing explains the marketable surplus of the crop, and hence, it indicates the available quantities for local consumption and for commerce. Generally, marketable surplus is important because it determines the distributed quantities of the crop through the market, storage and consumption.

To study the factors related to the marketable surplus the Cobb-Douglas production function was applied after transformation of the values into logarithms.
The following variables were used to determine factors affecting the marketable surplus of faba bean in the study area. The dependent variable (Y) is the total marketable surplus by the producers per sack. The independent variables include: total faba bean produced per sacks(90 Kg) in season 2002/03 (X_1); total faba bean reserved as seeds for the next season per sack (X_2); Farmers educational level(X_3); total faba bean reserved for consumption by household per sack (X_4).

Table 2. Factors Affecting Faba bean Marketable Surplus

Variables	Coefficients	Standard Errors	T-values	Level of Significance
Intercept	-0.256	0.106	-2.425	*
Production	1.063	0.091	11.670	***
Seeds	-0.427	0.147	-2.907	**
Education	0.533	0.228	2.344	*
Consumption	-4.201	0.163	0.258	

R-square = 0.90 Adjusted R-square = 0.88
F-value = 47.45
*** Significant at 99% level of probability.
** Significant at 95% level of probability.
* Significant at 90% level of probability.
Source: field survey, 2003.

The significant variables have the expected right signs with their coefficients. The reserved as seeds coefficient is -0.43 at 95% level of significance meaning that about 50% of farmers have stored amounts of their harvest as seeds for the next season.
The dummy variable educational level coefficient is 0.53 at 90% level of significance. The significance of this variable may be due to the variation among the farmers which appear in their rational marketing behavior such as time and place of selling. The positive sign of the coefficient reflected the positive relation between education and marketable surplus of faba bean in the study area.

Conclusions and Policy Implications

This study concluded that education is an important factor improving the faba bean production and marketing. The lower terrace land (20%) is better for faba bean production than the high one (80%). The costs of irrigation, seeds and land preparation are the highest cost items in the process of faba bean production. The unfavorable climatic conditions, pests and diseases, poor cultural practices, and shortage of irrigation are the most important factors lowering the yield of the crop.
The unavailability of formal credit and limited informal credit as well as faba bean prices fluctuations are usually decreasing farmers' returns.
Accordingly the study proposed the following recommendations:

- Because irrigation water is the main constraint facing faba bean production in the study area due to the high input cost (fuel, oil, spare parts, and labor), intervention is needed to ease having this inputs either by subsidizing it or providing means of credit to enable farmers to keep their pumps working.
- Improved seeds with a reasonable or subsidized prices as well as intensive role of extension are urgently needed to help deviating farmers from using old varieties and infected seeds of faba bean which resulted in low yield.
- The joint initiative between farmers' union, lending institutions, and the State government should plan a seasonal finance at low interest rate and easy terms of repayment to improve

the small poor farmers' financial situation and to encourage an effective use of loans by them.

Integrated crop markets need to be established to provide a guarantee to farmers that their production would be sold through a fair system. Moreover, farmers' cooperative union should play the role of the intermediate middlemen between the farmers and the market system eliminating the brokers' intervention.

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