GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 149 - 152
 ISSN 1596 – 2903

# ECONOMIC EFFECTS OF BEE POLLINATION ON MAIZE YIELD IN FURO, FUFORE LOCAL GOVERNMENT AREA, ADAMAWA STATE, NIGERIA

**M. R. JA'AFAR-FURO**

(Received 8 May, 2006; Revision Accepted 12 March, 2007)


## ABSTRACT

The economic effects of bee pollination on maize yield in Furo, Fufore local government area, Adamawa state, Nigeria, were determined. Data were obtained from two (2) experimental farm plots (A and B) of two (2) hectares each for two (2) cropping seasons (2003 and 2004). The mean yields of the two (2) years for the farm plots were used for the gross margin analysis. Results showed that the bee-pollinated maize farm plots yielded 21.23% higher than the maize farm plots pollinated from other sources. This gave a gross margin of ₦197,095.00 and ₦121,120.00 for bee-pollinated maize farm plot and maize farm plot pollinated from other sources respectively. It was concluded that bees enhance pollination in maize and by extension increase the yield of the crop. The government and private institutions should therefore, incorporate the use of bees in their extension programmes as a strategy of improving the farmers' crop yield in the country.


**KEYWORDS:** Bee, Farm, Maize, Plot, Pollination.

## INTRODUCTION

The dwindling aspect of crops yield in the sub-saharan Africa is creating great concern in the minds of both agricultural scientists and the farmers in general. Of the various efforts made towards addressing this problem in Nigeria for instance, the use of inorganic fertilizers which mainly composed of Nitrogen, Phosphorus and Potassium, improvement of seeds variety and farm equipment have been on the increase in the recent past.

Inspite of these efforts, noted Odigbo and Onwualu (1994), the imbalance between the food demand and the actual production continued to widen. Okon (2002) observed that the high thermal conductivity for inorganic fertilizers could be detrimental to the seedling emergence and /or their growth rate which consequently lead to low yield of crops unlike the reverse experienced with the use of organic manure. In his attempt to find reasons for poor performance in the agricultural sector in the developing world, Rossett (2002) reported the inability of the local authorities to tailor agricultural technologies that are in conformity with the small-scale farmers' variable but unique circumstances, in terms of local climate, biodiversity, resources among others, as the main reason for low productivity. Whereas studies like Robinson *et al.* (1989), Hoff and Phillips (1990) and Lasalle and Gauld (1992) all effectively appraised the value of bee pollination in the United States and Australia in the developed world, the aspect of improvement in pollination of crops has not been properly documented in this part of the globe.

Be that as it may, the fact still remains that 90 million of the Nigeria's population live in rural areas. Of this number, over 70 percent live below poverty line. Many of these rural poor are subsistent farmers (Eni and Ugoani, 2003). The search for solutions towards improving their productivity must therefore, continue. This experimental study is an addition to the various efforts of the successive governments of Nigeria in increasing the food production by the teeming farmers who reside in the rural areas. It is hoped that other communities of similar economies would benefit from this attempt.

## MATERIALS AND METHODS

The experiment was carried out in two (2) different farm plots (A and B) of two (2) hectares each situated about five (5) kilometers apart in Furo area of Daware district, Fufore local government area of Adamawa state, Nigeria. The virgin camisoles (soil) farm plots (A and B) in the *Fadama* (lowland) were cleared, ploughed and harrowed using a tractor. Plantings using TZB (white variety) maize variety were effected in February of the two (2) production seasons (2003 and 2004). Water pumps were used to irrigate the lands at the interval of three (3) days in the evenings in the period under consideration. Urea and NPK (Nitrogen, Phosphorus, Potassium) fertilizers in the ratio 46% (urea) and 15:15:15% (NPK) and quantity of 150Kg and 200Kg respectively, as first and second applications were made on each farm plot and for each season. In addition to above, four (4) 27-bar Kenya top-bar colonized (*Apis mellifera*) beehives of 96cm (length) x 56cm (Top width) x 26cm (height) x 21cm (base width) were placed at different locations in farm plots A and B for the period of three (3) weeks with the aim of facilitating pollination in 2003 and 2004, respectively. In other words, the beehives were used in plot A in 2003, whereas the plot (A) was allowed to be pollinated from other sources in 2004. Similarly, plot B was pollinated from other sources in 2003 and arranged to be pollinated by bees in 2004. Two (2) security personnel were employed to guard against vandals (one in each farm plot). The harvests of two (2) farm plots were effected in the first week of May of every cropping season. The means of both farm plots were obtained for the analysis.

**M. R. Ja'Afar-furo,** Department of Agriculture and Natural Resources Fufore Local Government Area, Adamawa State, Nigeria.

RESULTS

**Table 1: The gross margin of a bee-pollinated maize farm plot in Furo, Fufore local Government, Adamawa state, Nigeria.**

| Criterion | Qty | Unit Cost (₦) | Total (₦) |
|---|---|---|---|
| **A) Revenue** | | | |
| Threshed maize | 97.5(100Kg bag) | 3750 | 365625 (92.51) |
| Corn stock | 148 (bale) | 200 | 29600 (7.49) |
| Gross Revenue (GR) | - | - | 395225 (100) |
| **B) Variable Cost** | | | |
| Clearing of farm plot | - | - | 2500 (1.26) |
| Ploughing | - | - | 6500 (3.28) |
| Harrowing | - | - | 3800 (1.92) |
| Planting | - | - | 3000 (1.51) |
| First weeding | - | - | 12000 (6.06) |
| Second weeding | - | - | 9000 (4.54) |
| Third weeding | - | - | 7900 (3.99) |
| Harvesting | - | - | 8200 (4.14) |
| Threshing and bagging | 97.5 bags | 200/bag | 19500 (9.84) |
| Gathering of corn stock | 148 bales | 20/bale | 2960 (1.49) |
| * Transportation | | | |
| Bags of maize | 97.5 bags | 100/bag | 9750 (4.92) |
| Farm materials | - | - | 8940 (4.51) |
| * Fertilizers | | | |
| Urea | 300Kg | 1980/50kg bag | 11880 (6.01) |
| NPK | 400Kg | 1950/50kg bag | 15600 (7.87) |
| SSP | 400Kg | 1460/50kg bag | 11680 (5.90) |
| * Treated seeds | | | |
| TZB (white variety) | 20Kg | 1000/1kg | 20000 (10.09) |
| Hire of water pump | 30days | 300/day | 9000 (4.54) |
| Empty 100Kg bags | 98' | 40/bag | 3920 (1.98) |
| Ground rent | 2 hectares | 10000/hectare | 20000 (10.09) |
| Security man | 3months | 4000/month | 12000 (6.06) |
| **Total Variable Cost (TVC)** | - | - | **198130 (100)** |
| **C) Gross margin (GM) (GM = GR – TVC)** | - | - | **197095** |

**Note:** Values in parentheses show percentage of gross revenue and total variable cost, respectively.
Naira (₦) 140: US$1
Source: Field survey (2003 and 2004)

**Table 2: The gross margin of a maize farm plot pollinated from other sources in Furo, Fufore local Government, Adamawa state, Nigeria.**

| Criterion | Qty | Unit Cost (₦) | Total (₦) |
|---|---|---|---|
| **A) Revenue** | | | |
| Threshed maize | 76.8 (100Kg bag) | 3750 | 288000 (92.43) |
| Corn stock | 118 (bale) | 200 | 23600 (7.57) |
| Gross Revenue (GR) | - | - | 311600(100) |
| **B) Variable Cost** | | | |
| Clearing of farm plot | - | - | 2500 (1.31) |
| Ploughing | - | - | 6500 (3.41) |
| Harrowing | - | - | 3800 (1.99) |
| Planting | - | - | 3000 (1.57) |
| First weeding | - | - | 12000 (6.30) |
| Second weeding | - | - | 9000 (4.72) |
| Third weeding | - | - | 7900 (4.15) |
| Harvesting | - | - | 8200 (4.30) |
| Threshing and bagging | 76.8 bags | 200/bag | 15360 (8.06) |
| Gathering of corn stock | 118 bales | 20/bale | 2360 (1.24) |
| * Transportation | | | |
| Bags of maize | 76.8 bags | 100/bag | 7680 (4.03) |
| Farm materials | - | - | 8940 (4.69) |
| * Fertilizers | | | |
| Urea | 300Kg | 1980/50kg bag | 11880 (6.24) |
| NPK | 400Kg | 1950/50kg bag | 15600 (8.19) |
| SSP | 400Kg | 1460/50kg bag | 11680 (6.13) |
| * Treated seeds | | | |
| TZB (white variety) | 20Kg | 1000/1kg | 20000 (10.49) |
| Hire of water pump | 30days | 300/day | 9000 (4.72) |
| Empty 100Kg bags | 77 | 40/bag | 3080 (1.62) |
| Ground rent | 2 hectares | 10000/hectare | 20000 (10.49) |
| Security man | 3months | 4000/month | 12000 (6.30) |
| **Total Variable Cost (TVC)** | - | - | **190480 (100)** |
| **C) Gross margin (GM) (GM = GR – TVC)** | - | - | **121120** |

**Note:** Values in parentheses show percentage of gross revenue and total variable cost, respectively.
Naira (₦) 140: US$1
Source: Field survey (2003 and 2004)

## DISCUSSION

Although *Zea mays* is generally regarded as being *anemorphilous* (successful pollination relies on wind dispersal of pollen), maize pollen is also collected by bees (Emberlin *et al*,1999). Earlier studies, which also showed the evidence that maize pollen is collected by bees, are available from experimental results and monitoring (Percival, 1947, 1955; Nowakowski and Morse, 1982; Vaissiere and Vinson, 1994). Of the pollen types that were discovered by Mourizio (1951) to be extremely important to bees, *Z. mays* was amongst the pollens that were found to stimulate the development of brood food glands, ovaries and also prolong the life span. Farooq *et al.* (2004) emphasized on the use of honeybees by the farmers in the Hindu Kush Himalayas in promoting their mountain agriculture through pollination of their field crops (maize inclusive), fruits and vegetables.

All these studies strongly suggest that honeybees could be effectively utilized to facilitate pollination in *Z.mays*. However, many farmers have poorly understood this aspect. This study is therefore, an attempt to evaluate the economic benefits or otherwise of honeybees on the yield of maize as the major stable crop in the state.

The results in Table 1 indicate the gross margin of bee-pollinated maize farm plot. Gross revenue of ₦395225 was realized from the two production periods. The total variable costs, which formed the inputs procurement costs, was ₦198130. Thereby bringing the gross margin of this maize farm plot to a sum of ₦197095. Table 2 shows the gross margin of maize farm plot pollinated from other sources. Similarly, positive gross revenue of ₦311600 was obtained from the two cropping seasons. While the total variable cost was ₦190480, a sum of ₦121120 was recorded as the gross margin for the period under consideration.

Comparatively, it could be observed from the two tables (1 and 2) that the bee-pollinated maize farm plot (Table 1) yielded 20.7 bags of threshed maize higher than the maize farm plot pollinated from other sources (Table 2), accounting for about 21.23% of the total yield. This gives equivalent farm revenue of ₦77625 higher in Table 1. Also, a sum of ₦75975 higher was recorded for the bee-pollinated maize farm plot (Table 1) in terms of gross margin.

The implication of the above results is that although *Z. maiys* (maize) is being regarded as *anemophilous*, honeybees can also enhance the pollination of this popular crop and by extension increase the yield, of which in this study, by not less than 21%.

## CONCLUSION AND POLICY IMPLICATION

The results of comparative analysis of this study had shown that inspite of the fact that maize has been mainly considered as *anemophilous* crop, honeybees (*A. mellifera*) can improve the yield of *Z. mays* immensely.

It is therefore, recommended that the government should include the use of honeybees in their extension packages as measure of enhancing the crop production of the small-scale farmers who form the bulk of food producers in the country.

**ACKNOWLEDGEMENTS**

I am grateful to both the Adamawa state local government services commission, Yola, Nigeria and the authorities of the Fufore local government area, Adamawa state, Nigeria for financing this study.

**REFERENCES**

Emberlin, J., Adam-Groom, B. and Tidmarsh, J., 1999. A report on the dispersal of maize pollen. Commissioned by Soil Association based on evidence available from publications and internet sites. 27pp.

Eni, H. and Ugoani, A., 2004. Yielding Gains Gradually. Special feature.Tell Magazine No.1. January 5, Nigeria. P23

Farooq, A., Partap, U., Joshi, S. R. and Gurung, M. B., 2004. Indigenous honeybees: Allies for mountain farmers. In: Campen, E.V. (ed) Magazine on Low External Input and Sustainable Agriculture: 20(4):12-13

Hoof, F.L. and Phillips, J. K., 1990. Honey Background for 1990 farm Legislation, Washington D.C., U.S. Department.

Lasalle, J. and Gauld, D., 1992. eds. Hymenoptera and Biodiversity. C.A.B. International, Wallinford. 348pp.

Maurizio, A., 1951. Untersuchungen uber den Einfluss der Pollenernahrung und Brutpflege auf die lebensdauer und den physiologischen Zustand der Bienen. Report of the 14th International Beekeeping Congress. Leamington Spa. P320.

Nowakowski, J. and Morse, R., 1982. The behaviour of honeybees in sweet corn field in New York State. America Bee Journal. 13:16.

Odigbo, E. U. and Onwualu, A. P., 1994. Mechanization of Agriculture in Nigeria: A critical Appraisal. Journal of Agricultural Technology. 2:2-3.

Okon (2002) In: Maunde, F.A. and Sajo, A. A., 2004. Effects of Fertilization on maize yield at Sangere, Girei Local Government, Adamawa State. Journal of League of Researchers in Nigeria: 4(2):38-46.

Percival, M.S., 1949. Pollen Collection by *Apis mellifera*. New Phyto. 46:142-165

Percival, M.S., 1955. The Presentation of Pollen in certain angiosperms and its collection by *Apis mellifera*. New Phyto. 54:353-368.

Robinson, W.S., Nowogrodzki, R. and Morse, R. A., 1989. The Value of honeybees as Pollinators of U.S. Crops. American Bee Journal. 129:411-487

Rossett, P., 2002. Genetically Engineered crops-Will they feed the hungry and reduce Poverty? In: Nielsen, F. (ed.) Low External Input and Sustainable Agriculture. 17 (4):4-7

Vaissiere, B. and Vinson, S. B., 1994. Pollen Morphology and its effects on Pollen collection by honeybees, *Apis mellifera L. (Hymenoptera: Apidae)*, with special reference to upland cotton, *Gossypium hirsutum L. (Malvacaece)*. *Grana*. 33:128-138