ECONOMICS OF INSECT PEST CONTROL ON FIELD BEANS

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Field bean (Phaseolus vulgaris L.) is the most important grain legume grown in Tanzania. Bean yields under subsistence farming are generally very low. Insect pest damage is among the main constrains to production of beans in Tanzania. Heavy losses in beans due to individual pests have been recorded. However, few reports on yield losses due to bean pest complex, and monetary gains and benefit-cost ratio for insecticide application on field beans are available. These informations are reported in this paper.

The study was conducted with 'Kabanima' variety of beans. A randomized complete block design, replicated four times, was used. Individual plots consisted of 12 rows, 6m long and 50 cm apart with an intrarow spacing of 10 cm (200,000 plants/ha). Four treatments were included : (i) no insecticide application (control check), (ii) insecticide application before flowering (at 27 and 40 days after planting, DAP), (iii) insecticide application after flowering (at 57 DAP), and (iv) insecticide application throughout crop growth (at 27, 40 and 57 DAP). Sprays of Roger E (dimethoate 40 EC) at the rate of 600g (AI)/ha in 400 litres of water were made. Sampling for insect pests was done at weekly intervals by randomly selecting plants in each plot.

Economic estimate of seed yield losses due to pests was made using the National Milling Corporation (NMC) market price of beans in Tanzania. Cost of insecticide and labor were used to estimate the cost of insecticide application. Benefit-cost ratios for insecticide application for the control of insect pests were also calculated. All data were subjected to analysis of variance and means were separated by Duncan's multiple range test. Correlation coefficient between yield and yield components were also calculated.

Bean fly (Ophiomyia phaseoli Tyron) and foliar beetle (Ootheca bennigseni Weise) caused more damage during pre-flowering growth stage, between 10 and 40 DAP. The major post-flowering pests from 40 to 70 DAP were the spiny pod-sucking bug (Clavigralla shadabi Dolling), the spotted pod borer (Maruca testulalis Geyer) and the tropical boll worm (Heliothis armigera Hübner).

The seed yield was highest (774 kg/ha) in plots treated against pests throughout the season and least (409 kg/ha) in the control treatment. The seed yield in control treatment was significantly ($P < 0.05$) less than rest of the treatments. Seed yield increased with increasing number of insecticide applications. Negative correlation coefficient of 0.58 between per cent pods damaged and seed yield implies that the higher the pod damage the lower will be the seed yield.

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The seed yield gains were, respectively, 37.4, 37.5 and 47.2 per cent for plots treated with insecticide before flowering, after flowering and throughout the growth stages (Table 1). The corresponding monetary gains due to insecticide application were TShs. 1,952, 1,816 and 2,920/-. This is equal to respective benefit-cost ratio of the order of 8:1, 14:1, and 8:1. Although a benefit-cost ratio of 1.5:1 is satisfactory for sophisticated agriculture, Bernet(1974) emphasized that for subsistence farming a benefit-cost ratio of 3:1 may be required for taking up insecticide application for pest control. The benefit-cost ratios for all treatments were quite high and are certainly profitable even during the years of high pest infestation.

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Reference : Bernet, E.E. 1974. Economic aspects of pesticide use with special reference to African conditions, pp 1-36. In Proceedings of Seminar on the Efficient and Safe Use of Pesticide in Agriculture and Public Health in Africa, Nairobi, Kenya.

Table 1. Per cent seed yield loss due to insect pests, the net monetary gains, and benefit-cost ratio for insecticide application on field beans in Tanzania.

Treatment	Seed yield[a] (kg/ha)	% seed yield gain due to pest control	Total[b] monetary gain due to insecticide application (TSh/ha)	Cost of insecticide application			Benefit-cost ratio
				Cost of insecticide[c] (TSh)	Labor[d] cost (TSh)	Total cost (TSh)	
No insecticide application (Control check)	409b	-	-	-	-	-	-
Insecticide application before flowering	653a	37.4	1,952.00	231.00	23.05	254.05	8:1
Insecticide application after flowering	636a	35.7	1,816.00	115.00	11.50	127.00	14:1
Insecticide application throughout	774a	47.2	2,920.00	346.60	34.60	381.10	8:1

[a]Means followed by the same letter are not significantly different ($P < 0.05$; Duncan's multiple range test).

[b]Bean seed value calculated at 1984 NMC buying price of TSh 8.00 per kg (1 TSh = US $ .10).

[c]Based on 1984 price for dimethoate (rogor E) 40 EC at TSh. 77.00 per litre of commercial formulation.

[d]Labor cost of insecticide application based on an application per ha in TSh. The wages for labor based on TSh. 23.05 per man-day of 10h.