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Contribution of Some Sorghum Production Factors towards Yield and Economic Return at D.I. Khan

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Abstract: Contribution of different factors responsible for the increase of sorghum production viz fertilizer, insecticide and weed control were studied in Kharif 1998 and 1999 under agro-climatic conditions of D.I.Khan (NWFP). The investigation measured the average maximum gap between the farmer's practices and that of improved practices as 2058Kg ha^{-1}, showing an increase of 136 percent over that of farmers practices. The highest share was contributed by fertilizer 45.29 percent followed by insecticide 41.71 % and weed control 12.91 %. The highest net return and value cost ratio (VCR) of Rs.5202 ha^{-1} and 1:2.26, respectively were found for fertilizer. The minimum net return of Rs.922 ha^{-1} was obtained for weed control.

Key words: Sorghum, fertilizer, weed, insect/pest, grain yield, cost analysis, NWFP

Introduction

Sorghum (*Sorghum bicolor* L. Mounch) is used as staple food in some part of the country and its demand for fodder and feed is expanding due to increase in live stock and poultry population. Sorghum crop has more grain yield potential than is usually recognized, but in Pakistan its average yield is comparatively low due to unadoptability of improved verities and modern production techniques. The yield of sorghum is 617Kg ha^{-1}. In Pakistan farmers, usually plant sorghum crop by broad cast method getting very poor stand, apply no weedicides and use no insecticide, resulting some time 100 % failure of the crop due to excessive weeds and insect damage (Anonymous, 1999-2000).

By now it is well recognized that input like balance use of fertilizer, plant production measures and weed control etc. each has an effective role in increasing yield of the crop.

Howard and Lessman (1989) conducted a field experiment and reported that increasing N rate, increase the grain yield. Sharma *et al.* (1988) conducted field experiment, investigating the sorghum to different level of phosphorus under rainfed conditions and they concluded that grain as well as straw yield increased with up to 110Kg ha^{-1} of P_2O_5. Sonar *et al.* (1990) investigating the fertilizer requirements of sorghum and observed that 100 Kg of sorghum required 2.00 Kg N, 0.34 Kg P. Ahmad *et al.* (2001) reported the contribution of some maize production factors and fertilizer, weed control and insect/pest control at improved level gave the higher net return of Rs. 3975/-, Rs.2324/- and 1577.50 with VCR of 2.2, 2.26 and 1.47 respectively. Ahmad *et al.* (1999) reported that highest yield of 3.29tons ha^{-1} was obtained when improved technology was adopted where as the lower yield 1.78tones ha^{-1} was obtained in case of farmer practices.

The study was initiated to determine the contribution of improved practices viz., fertilizer, pest and weed control on the yield of sorghum and to evaluate the yield gap between farmer and improved technology.

Materials and Methods

In order to assess the gap between farmer yield and yield due to improved practices, research on relative effect of fertilizer, insecticide and weedicide measure on grain yield of sorghum was carried out at Agriculture Research Institute D.I.Khan, NWFP during 1998 and 1999. The treatments used were given in Table 1.

In the first test factor, which was fertilizer, 45Kg ha^{-1} N (half at sowing and half 35 days after sowing was applied in case of farmer practices (FP) while 90-45Kg ha^{-1} NP was applied in case of improved practices (IP). Half N and all P were applied at sowing time and remaining N was side dressed before second irrigation.

In the second test factor, which is insecticide, no insecticide was applied in case of farmer practices, while furadon 3G @ 40Kg ha^{-1} each at 20 days interval was applied in case of improved practices.

Regarding the third test factor, which is weeding, no weeding was done in case of farmer practices while two manual weeding were done in case of improved practices (Ahmad *et al.*, 2001).

Table 1: Details of the treatments, fertilizer, pest control and weeding

Treatments	Fertilizer NP (kg ha^{-1})	Pest control (kg ha^{-1})	Weeding
T_1 (Farmer practices)	45-0	Nil	Nil
T_2	45-0	Nil	Two manual
T_3	45-0	Furadon 3G @ 40	Nil
T_4	90-45	Nil	Nil
T_5	45-0	Furadon 3G @ 40	Two manual
T_6	90-45	Nil	Two manual
T_7	90-45	Furadon 3G @ 40	Nil
T_8 (Improved practices)	90-45	Furadon 3G @ 40	Two manual

The field experiment was designed to estimate per hectare potential yield gap, factor contribution and yield level of various treatments. The dimension of each plot was 2.4 X 5 m^2. Random sampling technique was applied for assigning and given treatment to cover heterogeneity of the soil if any (Ahmad *et al.*, 2001). Improved variety of sorghum giza-III was used in this study.

During consecutive years the experimental design was randomized complete block design with factorial arrangements of treatments. The data was analyzed statistically as described by Leclerg *et al.* (1962).

Results and Discussion

The results showed that fertilizer, insecticide and weeding in term of improved practices have significantly increased the sorghum grain yield during both the years. Lowest grain yield of 1506Kg ha^{-1} was obtained from T_1 (FP), where only 45Kg ha^{-1} was applied (Table 2). Maximum grain yield of 3564Kg ha^{-1} was obtained from T_8 (IP), where 90-45 NP, 40Kg ha^{-1} furadon 3G and two manual weeding were done. The per hectare yield gap 2058Kg ha^{-1} was determine as the different between the yield obtained with all test factors at improved level (T_8) and yield obtained at farmer level (T_1). These findings are in agreement with the result reported by Ahmad *et al.* (2001), Satao and Nalamwar (1991) and Mascagni and Sabbe (1990).

There was 2058Kg ha^{-1} average yield gap for both the years, showing an increase of 136 % than that of farmer practices (Table 3). The contribution of fertilizer towards yield was 932.50, insect pest control was 858.50 and weeding was 267Kg ha^{-1}, respectively. It means that there was a great scope for increasing sorghum productivity. Fertilizer and insecticide application were prominent factors in this study. Their contribution towards grain yield increase was 45.29 and 41.71%, respectively during both the years (Table 3), while contribution of weeding towards grain yield was only 12.91%. A large potential yield gap and the significant contribution of individual test factor does not solve the

Table 2: Average grain yield of sorghum as affected by different factors of sorghum trial during kharif 1998 and 1999.

Treatments	Fertilizer NP (Kg ha^{-1})	Pest control (Kg ha^{-1})	Weeding	Average grain yield Kg ha^{-1} (both years)
T_1 (Farmer practices)	45-0	Nil	Nil	1506
T_2	45-0	Nil	Two manual**	1745
T_3	45-0	Furadon 3G @ 40*	Nil	2065
T_4	90-45	Nil	Nil	2314
T_5	45-0	Furadon 3G @ 40	Two manual	2507
T_6	90-45	Nil	Two manual	2436
T_7	90-45	Furadon 3G @ 40	Nil	3301
T_8 (Improved practices)	90-45	Furadon 3G @ 40	Two manual	3564

Weed control and insect/pest control = Nil in case of farmer practices *Application of furadon @ 20Kg ha^{-1} per time
**Two manual weeding, in case of improved practices

Table 3: Average yield gap and factor contribution for sorghum trial during year 1998 and 1999

			Per hectare yield (Kg)		
Improved practices	Farmer practices	Yield gap	a)Fertilizer*	b) Insect/pest control*	c) Weed control ^{Ns}
3564	1506	2058	932.50	858.50	267.50
	%		045.29	041.71	012.91

*Significant at P≤0.05 NS: non-significant a: 90-45 NP Kg ha^{-1} b: 40 kg ha^{-1} of furadon 3G, applied at 20 days interval
c: Two manual weeding with khudal

Table 4: Economic of average individual test factor for sorghum at Agriculture Research Institute, Dera Ismail Khan during 1889-1999

	Input cost		Add cost including	1/6th of factor contrib i.e., harvesting			Per hectare in rupees value of the contribution in Rs. 10.00/Kg		
Test factors	Farmer practices	Improved practices	Interest cost 10%	threshing etc cost plus Rs. 10.00 per 100Kg	Total added cost	Contribution of test factor (Kg ha^{-1})		Net return	Value cost ratio
Fertilizer	710a	2396.00a	1855.00	2267.75	4122.75	932.50	9325.00	5202.00	2.26:1
Insect/pest	--	2802.50b	3082.25	2088.00	5170.75	858.50	8585.00	3414.25	1.66:1
Weedicide	--	1000.00c	1100.00	650.00	1750.00	267.25	2672.50	0922.50	1.52:1

(a) Cost of urea @ Rs. 355/-bag of 50Kg and cost of DAP @ Rs. 630/-bag of 50Kg (b) Cost of 0.5Kg sevin dust @ Rs. 85/-Kg plus 40Kg furadon @ Rs. 69/- per Kg (C) Cost of two manual weeding @ Rs. 500/- per weeding (10 man day @ Rs. 50/-)

problem of a Pakistani farmer to adopt the improved technology unless he perceive the net return in his subject perspective. The basic idea behind the economic analysis is that the typical farmer is more likely to adopt the improved technology package when he is convinced of better monetary return over additional investment. The cost of individual inputs were worked out separately at improved and farmer level in rupees on per hectare basis (Table 4).

The cost of fertilizer applied in farmer practices was Rs.710/- while no insecticide and weeding expenses were charged. The cost of fertilizer was Rs.2396/- pest control Rs.2802.50 and weeding was Rs.1000/- Kg ha^{-1} , respectively in case of improved practices (Table 4). The difference between improved and farmers practices was turn as additional input cost for the given test factor. A 10% interest rate was added on the additional inputs cost to accommodate farmers opportunity cost for his investment. Additional 17% of the total out put value of the factor was added to total input cost to cover the harvesting, threshing, cleaning and weighting charges. Lastly Rs.10/- per 100 Kg was included as average transport cost from farm to threshing floor and from there to the nearest procurement center. The benefit cost ratio were calculated by dividing a additional output value by additional input cost. Fertilizer, insect/pest control and weed control gave the highest net return of Rs. 5202/-, 3414/- and 923/- with VCR of 2.26, 1.66 and 1.52 respectively (Table 4). Similar results were reported by Ahmad *et al.* (2001).

The yield gap between improved practices and farmer practices was 2058Kg ha^{-1}, which was more than double of the sorghum grain yield 1508 Kg ha^{-1} obtained with farmer practices. In the light of aforementioned findings it is concluded that 90-45 of NP, 40Kg ha^{-1} of furadon and two manual weeding be applied to sorghum for obtaining yield in the vicinity of 3564Kg ha^{-1}.

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