

Full Length Research Paper

Effect of aqueous extract of sun-dried neem (*Azadirachta indica A*) leaves on wheat yield under field condition

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Accepted 18 April, 2012

A study was conducted to assess the allelopathic effects of aqueous extract of sun-dried neem (*Azadirachta indica A*) leaves on wheat yield and its components in the agronomic research area, University of Agriculture, Faisalabad. Grain yield and different yield components of wheat, such as number of fertile tillers, grain/spike and 1000-grain weight, and spike length showed no significant either promotive or suppressive effect with the application of 0, 50 and 100% aqueous leaf extract of neem. However, the aqueous leaf extract of neem did not inhibit the wheat yield and yield components. Natural weedicide (aqueous leaf extract of neem) certainly had no polluting effect of chemicals on the wheat quality.

Keywords: Allelopathy, aqueous extract of leaves, wheat quality improvement, bio -weed eradication

INTRODUCTION

Wheat (*Triticum aestivum* L) is the principal food crop of Pakistan. Wheat area is 9.05 million hectares with 24.032 million tons yield in Pakistan (Govt. of Pakistan, 2009). Wheat is an important cereal crop and is used as staple food grain in Pakistan. It is mostly preferred as human food than any other cereal grain. The straw and by products of flour milling and industries are important source of feed for livestock. The fast growing population of the country makes it imperative to achieve matching increase in the rate of food production. Weed problem is becoming more and more acute. It is estimated that annual losses caused by weeds may be more than 10 billion rupees (Ahmed, 1992). System information regarding weed control is not available and benefits of applied inputs cannot be fully realized unless it is followed by proper weed control programme. Weed

competition may be eliminated by hand hoeing, herbicides and allelopathy. Weed control is therefore essential for obtaining high yield and better quality. Yield can be increased up to 50% by adopting different recommended practices, including weed management (Afzal, 1988) as an alternative of weed management strategy. The presence of allelochemicals in the crop residues and their effect on subsequent crop and weed growth are recognized (Putnam et al., 1983; Cheema, 1988). The allelochemicals once released are short lived in the environment and therefore do not disastrously upset the balance as the applied chemicals would.

Weed control resulted in an average yield increase of 17.9% (Berzeneyl, 1985). Wheat yield losses can only be minimized by adopting appropriate weed control measures. Traditional weed control methods are expensive, time consuming and weather dependant. With the migration of rural labor to urban centres, the situation is further aggravated. Herbicides are very useful and efficient in controlling weeds, but often they have health

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Table 1. Physico-chemical analysis of the soil.

Parameter	Unit	Value
pH (1:1)		8.52
ECe (1:1)	dS m ⁻¹	1.05
SAR	(m.mole _c L ⁻¹) ^{1/2}	3.38
CaCO ₃	%	9
OM	%	0.8
Sand	%	63
Silt	%	17
Clay	%	20
Textural class	Sandy loam	
Available N	mg kg ⁻¹	6.5
Available P	mg kg ⁻¹	4.3
Available K	mg kg ⁻¹	23

Table 2. Water analysis of tubewell.

Parameter	Unit	Value
pH	-	8.1
ECe	dSm ⁻¹	1.7
RSC	meq L ⁻¹	7.2
HCO ₃	meq L ⁻¹	9.5

hazards. This necessitates the search for some other methods of weed control which are effective, environment friendly and practicable under farmer's condition. Allelopathy is an active area of weed science research that has emerged recently with promising results. It provides a natural remedy against weeds.

The application of chemicals into an environment upset the balance to such an extent that genetically resistant species whether plants, bacteria or fungus become dominant in the ecosystem and are generally uncontrollable. In agro-forestry, there is a good chance that allelochemicals produced by inter cropped trees and shrubs will affect the food and fodder crops productivity; therefore, trees should be checked before being introduced to agroforestry system (Rizvi et al., 1990).

The extensive use of agrochemicals especially fungicides which to pose more of carcinogenic risk than other pesticides. These may give rise to undesirable biological effects on animals and human beings (Osman and Adul Rehman, 2003)

Neem (*Azadirachta indica* A) has engaged as an important source and has insecticidal, antiviral and nematicidal properties (Parmar, 1987). The present study was therefore conducted to investigate the suppressive effect of allelopathic substances of sun-dried neem leaves on the growth and yield of wheat.

MATERIALS AND METHODS

The field experiment was conducted at the Agronomic Research

Area, University of Agriculture, Faisalabad. The soil is normal having ECe=1.05 dS m⁻¹, pH=8.52, N= 6.5. P= 4.3 and K=23 mg kg⁻¹ (Table 1). Wheat variety Pasban-90 was used as a test crop. The experiment was laid out in a randomized complete block design (RBCD) with four replications. The temperature range during the study period was 10 to 37°C. All other agronomic practices were kept uniform in the field except treatment applications. In this study, aqueous extract was prepared using 1 kg ground sun-dried neem leaves in 10 L of distilled water for 24 h and then filtered through a filter paper. The experiment treatments are 0 (distilled water control), 50 and 100% v/v aqueous leaf extract. The crop was irrigated with tube well (Table 2).

Wheat crop was sprayed with these treatments after 30 days of sowing. Observations on the parameters e.g. number of fertile tillers (m²), plant height (cm), spike length (cm), number of grains per spike 1000-grain weight (g), straw and grains yield (kg/ha) and harvest index were recorded during the course of study.

The data obtained from this study was subjected to analysis of variance technique using the least significant difference test at 5% level of probability to compare the differences among treatment means (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Table 1 indicated that the aqueous leaf extract of neem had no significant effect on the number of fertile tillers, plant height, spike length, grains per spike and 1000-grain weight of wheat. It is revealed that all the treatments did not show any significant suppressive and promoting effect on the number of fertile tillers when compared with the control. This result showed that the presence of neem leaves allelochemicals had no toxic effect on wheat crop. However, 100% leaf extract produced more fertile tillers than other treatments.

These results supported the findings of Dalal et al. (1992) who reported that growth, crop height, branches per plant and leaves per plant are inhibited less by *A. indica*. The application of neem leaf aqueous extract had no remarkable effect on the wheat plant height as mentioned in Table 3. These results are in line with the work of Dalal et al. (1992) who reported that crop height of mustard and chickpea was affected less by the *A. indica*. It was observed in this study that there was no significant decrease or increase in the wheat spike length by the application of various doses of aqueous extract of neem. 8.3% decrease was noted at 100% neem leaf extract over the control which was statistically non-significant. These findings confirm the results of Dalal et al. (1992) who reported the inhibitory effect of neem on crops.

Grain number per spike is an important wheat component which could affect crop yield. No treatment over control was found to have significant increase or decrease in the number of grains per spike of the wheat. However, 8.04% reduction was observed at 100% concentration over the control, but was found statistically non-significant. These results are contrary with the findings of Hussain et al. (1985) who observed that leaf aqueous extract of neem reduced the productivity of wheat.

Table 3. Effect of aqueous leaf extracts of neem on growth parameters of wheat fertile tillers, plant height and spike length.

Treatment	Fertile tillers (m ²)	Plant height (cm)	Spike length (cm)
Control (distilled water)	328	75.3	9.0
100% v/v aqueous leaf extract	337	76.8	8.25
50% v/v aqueous leaf extract	316	78.9	8.75

Table 4. Effect of aqueous leaf extracts of neem on grain yield of wheat (kg/ha) and harvest/index.

Treatment	Yield (kg/ha)	Straw seed (kg/ha)	Harvest index (%)
Control (distilled water)	4174.9 ^{NS}	9265.9 ^{NS}	31.52 ^{NS}
100% v/v aqueous leaf extract	4338.3	9191.7	32.16
50% v/v aqueous leaf extract	4044.0	9485.2	29.89

N.S= Non significant.

Final grain yield is partially a function of the weight of grain. All the treatments were found to have significant inhibitory and stimulatory effect on the grain weight of wheat when compared with the control. These results are against the findings of Hussain et al. (1985) who reported that leaf aqueous extract of neem had inhibitory effect on the production of wheat, maize and millet crops.

Table 4 showed that grain yield, straw yield and harvest index had no significant effect by these treatments. Final grain yield of a crop is the function of various components in response to the environment and inputs used. Wheat crop was un-affected by the application of various concentration of aqueous leaf extract. 50 and 100% concentration of aqueous leaf extract of neem did not show any effect over the control which shows that the allelochemicals present in neem leaves are not toxic to the grain yield of wheat. These results are opposite with the work of Verinumbe (1987) who reported that in pot experiment, highest crop yield of maize and sorghum was obtained on soil under *A. indica*.

The straw yield of wheat had no significant change by the utilization of aqueous leaf extract. These results are not in line with the findings of Hussain et al. (1985) and Verinumbe (1987) who reported that *A. indica* have significant effect on the production of various crops.

Harvest index is the relationship between economic yield and biological yield. Data on harvest index in Table 4 clearly showed that harvest index was not statistically affected under different concentrations of leaf extract. Application of 50% aqueous leaf extract of neem had a non-significant decrease of 7.38% over the control where 100% aqueous leaf extract of neem leaves showed a minor increase of 2.4% over the control. These results are contrary with the findings of Hussain et al. (1985) who reported that neem exhibited phytotoxicity of wheat, maize, millet and mustered.

Conclusion

Grain yield and different yield components of wheat like the number of fertile tillers, grain/spike, 1000-grain weight and spike length showed no significant effect either promotive or suppressive with the application of 0, 50 and 100% aqueous leaf extract of neem (*A. indica*). However, the aqueous leaf extract of neem (*A. indica*) did not inhibit the wheat yield and yield components. Natural weedicide (aqueous leaf extract of neem) certainly had no polluting effect of chemicals on the wheat quality.

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