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Research Article

EVALUATION OF ISOPROTURON ON PROTEIN & CHLOROPHYLL CONTENT IN LATE SHOWN WHEAT (*TRITICUM ASTIVUM)*

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ABSTRACT
In present investigation *Triticum astivum* seed were soaked in weedicide Isoproturon to check the adverse effect of *Phalaris minor* on crop productivity. The constituent of *Triticum astivum* as seed protein and chlorophyll were evaluated after cropping. Isoproturon in 3 doses 0.75, 1.00, 1.25 kg dissolve in 800 liters of water per hectare. It was treated at stage of Pre-immergence, 1st week of 1st irrigation and after 1st week of irrigation. Five plants from each plot were selected randomly and tagged. The growth observation was recorded from these plants at 45, 75 and 105 DAS (days after showing). Protein content in wheat grain increased significantly in all the weed treatment as compared to unweeded control during both the years. A high protein in wheat seed (14%) with increasing N rate in all the weed control treatment as compared 10% in untreated (Helgeson, 1948). Isoproturon is a selective herbicide and it does not inhibit the PS II of photosynthesis in wheat (Singh *et al.*, 1997). It is detoxified by cytochrome P450 mono oxygenase enzyme (Cabanne *et al.*, 1987). A positive relationship between wheat leaf chlorophyll content was found and higher rate of Isoproturon gave higher chlorophyll content in wheat plants.

Keywords: *Chlorophyll, DAS, Isoproturon, Phalaris Minor, Triticum Astivum, SPADI (Chlorophyll Meter)*

INTRODUCTION
Wheat (*Triticum aestivum*) as the most important contributor to the "bread basket" of the world and has special significance to Indian food security. It is cultivated throughout the world on an area of about 232million hectares. Out of the world's total wheat production of 657.96 million tons (MT), India contributes over 76.02 MT; 11.3% of world production.

A tremendous 3 fold increase in production of wheat during the last 3 decades has been observed. Total area under wheat in India, is 26.2 million hectares with total production of 72.0million tones during 2001-02. The national productivity has been increased from 6q/ha during 1950-51 to around 27q/ha during 2001-02. The national average productivity is 23.4q/ha but the average wheat yield of eastern UP (India) is 20.5q/ha.

The low productivity in eastern UP (India) is a matter of great concern to all agricultural scientist and planners. There are several reasons low yield of wheat in India and particularly of eastern UP. Amongst, late showing of wheat, losses cause due to weed are most important. The weed also have been major concern to poor average yield of wheat as average losses due to weed is about 30%.

The import of Mexican wheat varieties seed in India, carried with them the obnoxious weed viz little seed canary grass (Phlaris minor, RT_2), which alone reduces wheat yield to the extent of 30-80% (Brar and Singh, 1997; Angiras and Sharma, 1993).

The severity of crop weed competition intensity for nutrients increased further when any of the growth factor become limiting for growth and development of wheat crop.

Crops and weed have similar requirements for growth and development. Competition begins when crop and weeds grow in close proximity to each other and supply of a single nutritional factor falls below the requirement of both.

The overall effect of competition is a reduction in biomass and in the biomass and in reproduction potential of the competitors. The outcome of the competition depend not only the competing species but also on their density and the level of fertility.

Three most commonly limiting nutrients are NPK. N_2 is the first nutrient to become limiting as a result of crop weed competition. According to Arai (1967), competition for N_2 begins from about 20days after showing. Traditional manual weeding proved in-effective against *Phlaris minor*, due to its morphological resemblances to wheat crop before ear head emergence. Further continued germination of seed from soil-seed reserve require, repeated manual/mechanical weeding for effective control of this weed in wheat crop.

The acceptance of weed management technology in wheat has depending upon the stage of development, productivity level and input used pattern. In some areas herbicide use has been widely accepted in wheat, but in eastern region of India, use of herbicide has been partially accepted in wheat. Chemical weed control is gaining ground in the present day of intensive agriculture due to high labour wages and their unavailability during peak period of farm operations.

Phlaris minor is a major weed species in uncontrolled plot of wheat having relative population 11.5% along with other 6major weed species (Singh and Reddy, 1988). Malik *et al.*, (1995) reported P. minor as an important weed flora of wheat and the field was mainly infested with broad level weeds (Sharma and Singh, 1989).

Phlaris minor (canary grasses) and wild oat (Avena udoviciana) were dominated grasses along with other weeds (Balyan and Malik, 1992). Phlaris minor, C. album, Lathyus aphoca and M. indica, C. album constitute more than 80% of weed present in wheat field.

Pandey *et al.*, (1997) conducted experiments on both broad level and grassy weeds. In grassy weed P. minor was a dominated weed. Singh *et al.*, (1997) conducted experiment at Jabalpur and reported that *Phlaris minor* was among dominated grassy weed in wheat field. In Tarai of UP *Phlaris minor*, C. album and A. arvensis infested the wheat field (Prasad *et al.*, 1999).

Isoproturon is a selective, systemic herbicide used in the control of annual grasses and broad-leaved weeds in cereals (WHO, 2003).

Pure isoproturon occurs as colorless crystals which melt at 158°C. It's slightly soluble in water and polar organic solvents (Environment-agency, 2009). Isoproturon has a low tendency to adsorb to soils and is therefore quite able to enter in water bodies despite its rather low water solubility (70, 2 mg/l). Its half-life in water is 30 days, in soils 40 days (WHO, 2003).

MATERIALS AND METHODS

Isoproturon was carefully measured and dissolved in measured volume of water using 800 liters of water per hectare.

Herbicide Used:

Common Name	Trade name	Chemical name	Type of formulation with active ingradients
Isoproturon	Wonder	N'-4-isopropyl phenyl N, M-dimethyl urea	75% wt.

Selection of plants: Five plants from each plot were selected randomly and tagged. The growth observations were recorded from these plants at 45, 75 and 105 DAS (days after showing).

Chlorophyll content: Upper most leaf of wheat and *P. minor* plant by chlorophyllmeter (SPADI). Chlorophyll meter of all the 5 tagged plants were taken and average content of particular plot was worked out.

Protein content: Protein content was determined by the Folin phenol method described by Lowery *et al.*, (1951).

Agro-climatic condition: The agriculture research form situated in a region of subtropical climate being classified under moisture, deficit index of 20-40% and fall in belt of semi arid to cold winter. May and June are the hottest month with mean temp ranging from 38˚C to 46˚C. In the coldest month in Jan with min temp varying from 0˚C to 10˚C. The annual rain fall is 1100mm out of which about 84% is received

from June to Sept. The mean relative humidity is about 68% which rises up to 81% during July to Sept and fall down to 39% from the end of April to June.

Wheat Variety used: The selected wheat variety HUW-234 which was developed at IAS BHU in 1984. It was a cross variety of HUB-12*Sparrow*HUW-12. The plant is double dwarf (90-95cm) height. It shows multiple disease resistance and tolerance quality with a yield potential of 40q/ha in normal condition.

Table 1: Detail of Agricultural Preparations & activity

Field Activity	First year	Second Year
Preparing tillage	18 DEC	16 DEC
Layout	23 DEC	22 DEC
Showing	24 DEC	26 DEC
Fertilizer Application		
i. ½ N+P+K as basal dose	24 DEC	26 DEC
ii. ¼ N+P+K as top dressing	30 JAN	03 FEB
iii. ¼ N as top dressing	05 MAR	16 MAR
Irrigation		
1st Irrigation	20 JAN	21 JAN
2nd Irrigation	03 MAR	05 MAR
3rd Irrigation	20 MAR	22 MAR

Table 2: Applications of Herbicide First Yr and consequent Second Yr

SN	Application of Herbicide	First year	Second Year
1	Pre-emergence	21 DEC	30 DEC
	Before one week of 1st irrigation	13 JAN	15 JAN
	After one week of 1st irrigation	27 JAN	29 JAN
2	Innter culture		
	Hand weeding 1st T11	14 JAN	17 JAN
	Hand weeding 2st T11	07 FEB	10 FEB
	Hand weeding 3st T11	27 FEB	25 FEB
3	Date of Harvesting	22 APR	27 APR
	Threshing and winnowing	28 APR	04 MAY

Table 3: Details of Isoproturon treatments

SN	Details of treatment	Treatments
1	Isoproturon 0.75 kg (pre-emergence)	T1
	Isoproturon 1.00 kg (pre-emergence)	T2
	Isoproturon 1.25 kg (pre-emergence)	T3
2	Isoproturon 0.75 kg Before 1 week of isoproturon irrigation	T4
	Isoproturon 1.00 kg Before 1 week of isoproturon irrigation	T5
	Isoproturon 1.25 kg Before 1 week of isoproturon irrigation	T6
3	Isoproturon 0.75 kg After first week of irrigation	T7
	Isoproturon 1.00 kg After first week of irrigation	T8
	Isoproturon 1.25 kg After first week of irrigation	T9
4	Unweeded control	T10
	Weeded control(3hand weeding)	T11

RESULTS AND DISCUSSION

Observations and Results

Table 3: Protein content in wheat grain as affected by different isoproturon treatments

Isoproturon Treatment	Protein content First yr	Protein content Second Yr
T1	12.29	12.30
T2	12.33	12.36
T3	12.51	12.45
T4	12.24	12.36
T5	12.36	12.30
T6	12.42	12.56
T7	12.45	12.51
T8	12.64	12.80
T9	12.71	11.84
T10	12.03	12.74
T11	12.48	12.56
SEM±	0.070	0.096
CD at 5%	0.202	0.277

Protein Content in Wheat Grain

Application of Isoproturon after first week of irrigation had in general higher protein content was found in grains than pre-immergence, before one week of 1st irrigation, weed free and weedy check in both the years. Among Isoproturon treatments application of Isoproturon 1.25 kg/ha after 1st week of irrigation produced max protein content in both yrs. The treatment was at par with Isoproturon 1.0kg/ha applied after 1 week of irrigation in both the yrs, 1.25kg/ha pre-emergence in first year and hand weeding (T11) in second year and significantly superior to remaining isoproturon treatment in both the years.

The further analysis of data clearly indicates that increasing levels of Isoproturon application progressively increased the protein content in wheat grain irrespective of its times of application during both the yrs. However, all the treatment has significantly high protein content as compared to unweeded control during both the years.

Effect of Weed Control Treatments on Protein Content of Wheat Grain

Wheat grains protein content increases significantly with increasing level of Isoproturon at all the times of its application during both year investigations. Several other researchers have also obtained the similar results. In a study, Helgeson *et al.,* (1948) observed maximum protein content (14%) of wheat grain in weed free crop in comparison to unweeded treatment in which only 10% protein content was recorded.

Table 4: Chlorophyll content (SAPD) in wheat leaf at different stages of growth as effected by different Isoproturon treatment

SN	Treatment	Chlorophyll content(SPAD) 45days		Chlorophyll content(SPAD) 75days	
		First year	Second Year	First year	Second Year
1	T1	35.07	35.32	39.87	41.38
	T2	37.00	35.32	40.75	41.46
	T3	37.45	37.95	41.07	41.74
	T4	35.37	34.62	37.82	37.78
	T5	36.07	35.35	39.00	38.81
	T6	36.40	37.22	39.03	41.25
	T7	35.95	37.90	40.07	39.29
	T8	39.15	39.74	41.25	42.04
	T9	40.52	41.25	43.50	43.28
	T10	30.27	31.24	31.50	35.60
	T11	42.40	43.24	45.00	43.43
	SEM±	0.826	0.572	1.054	1.243
	CD at 5%	2.377	1.648	3.035	3.580

Chlorophyll Content in Leaves of Wheat at 45 and 75 days of Showing (DAS)

The max. Chlorophyll content was observed in hand weeding treatment (T_1) at both the stages during 1.25kg/ha applied after first week of irrigation was most effective in enhancing the chlorophyll content at all stages of observations during both the yrs. This treatment was at par with isoproturon 1.0kg/ha applied after 1st week of irrigation at all stage during both the yrs. 0.75kg/ha applied pre-emergence and 1.25kg/ha before one week of first irrigation at 75 DAS in second year and significantly superior to remaining isoproturon treatment in both years.

The further analysis of data indicated that hand weeding treatment (T_{11}) recorded more chlorophyll content as compared to all isoproturon treatments except isoproturon 1.25kg/ha applied after 1st week of irrigation. However, all the treatment had significantly higher content as compared to unweeded control during both the years.

Discussion

The possible mechanism for this increase in crude protein content might be due to more uptake of N2 in grain and the reduction of nitrate to ammonia by activities of complex enzyme resulting in production of more amino acids, which are the main constituent of protein. Garg and Tomaria (1970) have also reported that more availability of N2 to crop plant could be able to increase the protein content. Similarly Milar *et al.,* (1998) and Pandey *et al.,* (1998) has also observe increase content in wheat grain with increasing nitrate availability to crop plants. Further they also noted for increased protein content in grain in all the weed control treatments irrespective of their concentration in late shown wheat. Hence observation of this study is entirely in close agreement with the finding of the above studies.

The major breakdown pathways involve in the intoxification of isoproturon are hydroxylation and dimethylation mediated by the enzyme cyt P450 oxygenase monooxygenase the major metabolite of isoproturon often degradation are hydroxyl isoproturon monodesmethyl isoproturon and didesmethyl isoproturon etc. In a study, Singh *et al.,* (1998) observed increased Cyt P_{450} monooxygenase activity in wheat which provide resistant against Isoproturon.

Conclusion

The highest level of protein content in wheat grain was observed at all the levels of Isoproturon applied after first week of irrigation as compared to Isoproturon treatments of pre emergence and before one week of first irrigation during both the years.

Among Isoproturon treatments application of Isoproturon 1.25 kg/ha after first week of irrigation had max. Protein content in grain which was on par was Isoproturon 1.0 kg/ha and significantly after first week of irrigation and significantly superior to rest of the treatments in both the years. The max protein content was observed in Isoproturon 0.75 kg/ha before one one week of first irrigation during both the years. The max chlorophyll content in wheat leave was observed in hand weeding treatment at both the stage during both years. The increasing level of isoproturon application progressively increased the chlorophyll content in wheat leaf and protein content in grain irrespective of its time of application during both the years.

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