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Adoption rate of crop nutrition and protection chemicals in South-Western Zone of Punjab

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Abstract

It is estimated that crop yields would be approximately half of their current levels without the use of insecticides, fungicides and herbicides. So, the investigation was carried out in South-Western Zone (Faridkot district) of Punjab state during 2016-17 to know the extent of adoption of various crop nutrition and protection chemicals. From 2 blocks 3 villages were randomly selected; 20 respondents from each village were randomly selected thus making a sample size of 60 respondents for the study. Among Crop Nutrition, Neem coated Urea and Diammonium Phosphate adoption quotient were 100. Among Pesticide/Insecticide category, Thiamethoxam 25% WG adoption quotient was highest as it controls wide range of pests from stem borer to brown plant hopper (BHP). Among fungicide Mancozeb 63% W.P. + Carbendazim 12% W.P. combination was used to control Brown leaf spot of Rice and Late Blight of Potato and its adoption quotient was maximum among the fungicide i.e. 56.67. In herbicide/weedicide category Glyphosate 41% SL adoption quotient was highest among the weedicide i.e. 85 as it controls all kind of weed. Although, department of Agriculture, Punjab issued an order on October 23, 2018 that the glyphosate herbicide would be banned in the state due to its adverse health effects.

Keywords: Chelated zinc, crop protection, paddy-wheat, plant nutrition, soil health card.

Introduction

The world's population is expected to rise from the present 6.7 billion to over 8 billion by 2030 and thus agricultural land will be lost under the construction of various developmental projects [1]. So, the need for environment-friendly crop protection chemicals has never been more. Royal Society of Chemistry, Cambridge, United Kingdom has estimated that crop yields would be approximately half of their current levels without the use of insecticides, fungicides and herbicides [1]. Today, the Crop Protection sector produces insecticides, fungicides and herbicides in India and abroad. Moreover, soil is deficit in nutrition as evident from research conducted at 7 taluks of Mandya district in rice growing regions and it was discovered that out of 119 soil samples; 27 samples were deficient in available sulphur content [2].

Materials and Methods

The investigation was carried out in South-Western Zone (Faridkot district) of Punjab state during 2016-17 to know the extent of adoption of various crop nutrition (Urea, DAP, MOP, Zn-EDTA etc.) and protection chemicals (insecticides, fungicides and herbicides). In Faridkot both Faridkot and Kotkapura blocks were purposively selected. From these two blocks 3 villages were randomly selected; 20 respondents from each village thus making a sample size of 60 respondents for the study.

Study area

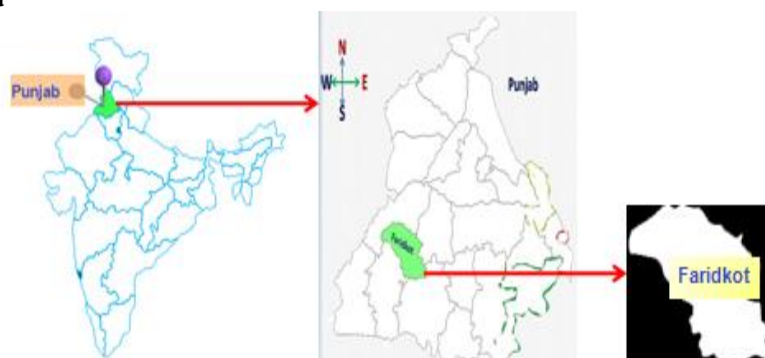


Fig 1: Location of the study area in India and Punjab

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Data collection

Total 60 respondents were interviewed personally through semi-structured pre tested interview schedule. The investigator met the respondents in person and explained to them about the purpose and benefit of the study. Data were collected in interview schedule (IS), coded in excel sheet and analyzed by using apposite statistical methods viz. mean, frequency, percentage and index for the interpretation.

Methodology

Adoption has been studied both as single-practice adoption behaviour as well as multi-practice adoption behavior [3]. Chattopadhyay and Pareek used adoption quotient index for measuring adoption which has ratio scale level of measurement [4]. In the present study the respondents adoption level was determined by calculating adoption quotient based on formula:

$$\text{Adoption quotient (A.Q.)} = \frac{\text{Number of respondents adopted}}{\text{Total number of respondents}} * 100$$

Results and Discussion

Crop Nutrition

Neem coated Urea has produced significantly higher yield as per trial on Paddy and Wheat crops. The fertilizer control order of July 2004 included the Neem Coated Urea and it has been found to improve the uptake of N, P and K significantly [5] and its adoption quotient was 100 (Table 1). Similarly, Diammonium Phosphate adoption quotient was 100 but

Murate of Potash adoption quotient was 78.33 and this was because soil health card report didn't found the land deficit in Potassium or farmers wanted to save the input cost. Zinc Chelate was used in the study area as its foliar application to crops is an effective way to increase the grain concentration of Zn [6]. Although, Zinc Chelate can be used as both soil and foliar application. Two frequently used Zn a foliar fertilizer (Zn sulphate and ZnEDTA) was used in wheat and paddy leaves. It would be noteworthy to mention here that Zn-EDTA is taken up in chelated form and not as ionic Zn (Zn^{2+}) [6] and its adoption quotient was 60. Due to application of Manganese sulphate leaves become broad and yellowness of leaves reduce in wheat. A field experiment was conducted at the farm of the CSSRI, Karnal, during 1992-1993 to evaluate manganese application on the yield and nutrition of wheat and it was revealed that basal, top-dressing or/and foliar spray of Manganese Sulphate Monohydrate ($MnSO_4.H_2O$; Manganese as Mn 30.5%; Sulphur as S 17%) increased grain and straw yield of wheat significantly with increasing rates of Mn application [7]. Due to this notable benefit $MnSO_4.H_2O$ adoption quotient was 81.67. Mycorrhizal bio-fertilizer is applied by mixing with urea and that increase root growth and nitrogen fixation. Mycorrhiza is a fungus root develops due to mutualistic symbiosis association between root-inhabiting fungi and plant roots rhizosphere. Mycorrhizal bio-fertilizer Granule is beneficial for crops suffering from nutrient deficiency viz., P and N [8]. Despite of its notable benefit its adoption quotient was meager i.e. 21.67.

Table 1: Adoption quotient of crop nutrition and protection chemicals in South-Western Zone of Punjab

(n = 120)

S. No.	Particulars	f	AQ
A.	Crop nutrition		
1.	Neem coated Urea	60	100
2.	Diammonium Phosphate (18-46-0)	60	100
3.	Murate of Potash K_2O - 60% (WS)	47	78.33
4.	Zinc Chelate (Zn-EDTA 12%)	36	60.00
5.	Manganous Sulphate Monohydrate ($MnSO_4.H_2O$)	49	81.67
6.	Mycorrhizal bio-fertilizer (Granular)	13	21.67
B.	Pesticide/Insecticide		
1.	Thiamethoxam 25% WG	53	88.33
2.	Cartap Hydrochloride 4% GR	41	68.33
3.	Monocrotophos 36% SL	19	31.67
C.	Fungicide		
1.	Carbendazim 12%+Mancozeb 63% WP	34	56.67
2.	Propiconazole 25% EC	22	36.67
3.	Isoprothiolane 40% EC	21	35.00
D.	Herbicide/Weedicide		
1.	Clodinafop-Propargyl 15% WP	27	45.00
2.	2,4 D, Dimethyl Amine Salt 58% SL	39	65.00
3.	Isoproturon 75% WP (Selective Herbicide)	43	71.67
4.	Glyphosate 41% SL Herbicide	51	85.00

Pesticide/Insecticide

Thiamethoxam 25% WG is a granular broad spectrum systemic insecticide having quick stomach and contact action. It controls sucking pests, stem borer, leaf folder, brown plant hopper (BHP), White Blacked Plant hopper (WBPH), Thrips, etc. in paddy; in addition it also controls Aphids, Jassids, and White Flies in cotton [9]. It is desirable to alternate Thiamethoxam 25% WG with other group of insecticides to evade resistance in long run. Due to its wider applicability its adoption quotient was 88.33. Cartap Hydrochloride 4% GR is an insecticide of Nereistoxin group, which controls pests through contact, systemic and stomach poison action [10]. It is

persistent insecticide, safe for environment and is also suitable for Integrated Pest Management (IPM) system. Cartap Hydrochloride 4% GR adoption quotient was 68.33. Monocrotophos 36% SL is a broad Spectrum Organophosphorus insecticide with both Systemic (systemic activity controls sucking pests) and contact action (chewing and boring insects are killed by contact action) [11]. The experts feel that the Monocrotophos to be responsible for the deaths and illness in Maharashtra. Monocrotophos is considered Class-I pesticides by the WHO; Class-I pesticides can be fatal at a very low dose; many of these are banned or restricted elsewhere in the world due to their high toxicity [12].

Due to the hazardous nature to the human health, Monocrotophos adoption quotient was only 31.67; this was due to awareness spread by extension professional among the farmers.

Fungicide

Mancozeb 63% W.P. + Carbendazim 12% W.P. is a combination of Mancozeb, contact fungicide of dithiocarbamate group and carbendazim, a systemic fungicide of Benzimidazole carbamate group was used to control Brown leaf spot of Rice and Late Blight of Potato in Faridkot districts [13]. Mancozeb 63% W.P. + Carbendazim 12% W.P. adoption quotient was maximum among the fungicide i.e. 56.67. Propiconazole 25% EC is a systemic fungicide and acts on the fungal pathogen at the stage of first haustoria formation; its formulation is in the emulsifiable concentrate (EC) and it checks rusts and leaf spot diseases in cereals [14]. Propiconazole 25% EC adoption quotient was 36.67. Isoprothiolane 40% EC is a systemic fungicide with protective and curative action to control paddy blast (leaf blast, collar blast, node blast, neck or panicle blast) [15]. As, paddy variety used in area was moderately resistant or tolerant to blast and so its adoption quotient was 35.

Herbicide/Weedicide

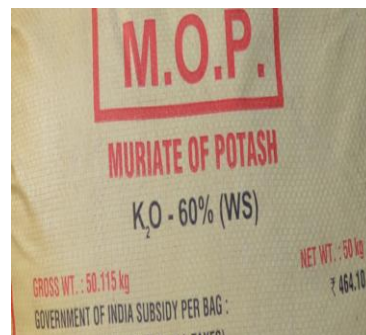
Clodinafop-Propargyl 15% WP is a post-emergence broad spectrum herbicide that controls Wild Oat in wheat [16]. Clodinafop-Propargyl 15% WP adoption quotient was 45. 2,4 D, Dimethyl Amine Salt 58% SL are the selective and systemic weedicides of Phenoxyacetic group used to control broad leaf weeds and it has no adverse effect on crops if recommended dose is applied [17]. 2,4 D, Dimethyl Amine Salt 58% SL adoption quotient was 65. Isoproturon {3-(4-isopropylphenyl)-1,1-dimethyl urea} was introduced as herbicide in 1987 [18]. Isoproturon 75% WP is urea-based selective post emergence herbicide used to control various broad-leaved weeds and several grassy weeds in wheat crop. Isoproturon 75% WP adoption quotient was 71.67. Glyphosate 41% SL is a non-selective systemic herbicide that controls all kind of weed and its adoption quotient was highest among the weedicide i.e. 85. Although, department of Agriculture, Punjab issued an order on October 23, 2018 that the glyphosate herbicide would be banned in the state due to its adverse health effects [19].



Yellow rust+Aphid in wheat leave



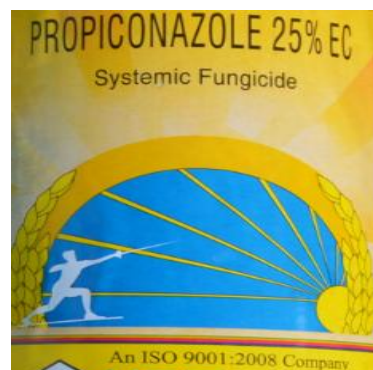
Power sprayer used for plant protection



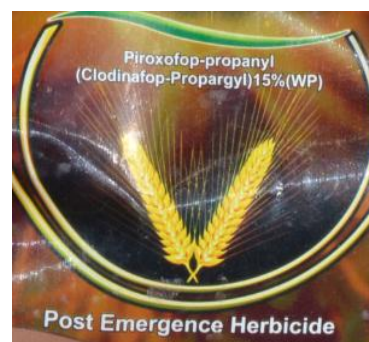
Murate of Potash



Broad spectrum systemic insecticide



Systemic fungicide



Post emergence herbicide

Fig 2: showing prevalent diseases, crop nutrition and protection chemicals

Conclusion

Approximately 800 chemicals are registered for crop protection across the globe. From the result of research it was observed that cent percent of the respondent adopted Neem coated Urea and Diammonium Phosphate adoption quotient were 100. Among Pesticide/Insecticide category, Thiamethoxam 25% WG adoption quotient was highest as it controls wide range of pests from stem borer to brown plant

hopper (BHP). Among fungicide Mancozeb 63% W.P. + Carbendazim 12% W.P. combination was used to control Brown leaf spot of Rice and Late Blight of Potato and its adoption quotient was maximum among the fungicide i.e. 56.67. In herbicide/weedicide category Glyphosate 41% SL adoption quotient was highest among the weedicide i.e. 85 as it controls all kind of weed but now it is ban in Punjab due to human health issue. Finally, it was also observed that respondent's Monocrotophos adoption quotient was only 31.67; this was due to awareness spread by extension professional among the farmers regarding its high toxicity.

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