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Research Article

INDIGENOUS PLANT PROTECTION PRACTICES IN DRY LAND AGRICULTURE AND ITS CHARACTERISTICS

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Abstract: The indigenous technological knowledge (ITK) possessed by farmers has received great attention and looking its potential in solving pest problem a study was carried out, six randomly selected villages from two blocks, one from each of Bhiwani and Mahendergarh districts of Haryana state. To explore indigenous technological knowledge (ITKs) 180 farmers with 10 years of experience were selected randomly from 6 villages. For testing innovative characteristics of each explored ITK, 40 agricultural scientists were selected purposively from two KVKs *i.e.*, Bhiwani and Mahendergarh, Department of Agronomy, Entomology and Plant Pathology of Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana. Data pertaining to study were taken by using personal interview method with open- ended and objective types of questions. Results indicated that 15 of ITKs were explored from farmers which are used against different insect pest management of various crops. Out of identified indigenous plant protection practices, farmers reported that 7 practices were highly profitable and practicable and 10 were considered highly simple and 12 were identified as highly sustainable. Whereas, the identified practices which were having low level of profitability, practicability, simplicity and sustainability were 5, 6, 3 and 3, respectively. Scientists found that 9 practices were highly profitable and practicable, 12 were considered highly simple and 13 were identified as highly sustainable. However, 3, 5 and 1 practice had low level of profitability, practicability and sustainability, respectively. We could observe that majority of plant protection practices are rated as highly profitable, practical and sustainable by the scientists. Soaking of pearl millet seeds in salt solution to control the ergot disease was perceived less profitable by farmers while scientists perceived it highly profitable but farmers did not accept it as an effective method to control disease. This might be due to farmer's misconception regarding salt solution that it reduces the seed germination. It could be inferred that there was very less gap in weighting the sustainability of explored ITKs by farmers and agricultural scientists both.

Keywords: *Indigenous technological knowledge (ITKs), Plant protection, Dry land agriculture, Innovative characteristics, Farmers*

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Introduction

Agriculture is the chief source of livelihood for millions of masses worldwide. Spectacular breakthrough in agricultural research, technology development and dissemination under the umbrella of green revolution has been major factors in increasing both agriculture production and productivity. Though agriculture mechanization, chemical fertilizers and pesticides all along the irrigation enabled the farmers to realize amazing yield increases, these innovations have also led to a fundamental loss of equilibrium. Insect pests are one of the major constraints in increasing the crop productivity, and indiscriminate use of pesticides, fungicides and herbicides could cause adverse changes in biological balance of well as lead to an increase in incidence of cancer and other diseases through the toxic residues present in the grain or others edibles parts. For instance, insecticide consumption in India, which was to the tune of 22013 tonnes, has increased to 51755 tonnes by 1994-95. Consumption of all of these pesticides in same duration has increased more than two times, that is from 24305 tonnes to 61357 tonnes. But in recent past, change has been observed in trends of pesticides consumption. In view of above problems, the need is felt to have the pest control agents that are specific, non-toxic to human and beneficial organisms, bio-degradable, less prone to pest resistance, resurgence and relatively less expensive. This traditional knowledge is the sum total of practices based on the peoples' experiences in dealing with situation and problems in various walk of life. As a result, a number of indigenous farm management practices have been evolved by the farmers. The indigenous technical knowledge, possessed by the farmers, has emerged out of field experiences passed from one generation to another orally. These practices were found to be more economical and effective over a long period of time. Therefore, there is a need to systematically document the Indigenous Agricultural Practices (IAPs). It is one of the major sources that are not utilized to their capacity. It is an unwritten body of knowledge. There is no systematic record to describe what it is, what it does, how it does, means of changing it, its operations, its boundaries and its applications. It is held in different brains, languages and skills in as many groups, cultures and environments [2 and 11]. Keeping these in view, the present study was formulated, to identify and analyze the ITK on plant protection practices in dry land agriculture, with the following specific objectives: To identify and evaluate the indigenous plant protection practices based on innovation characteristics.

Material and Methods

The study was conducted in Haryana state of India. Two districts, Bhiwani and Mahendergarh were selected purposively. One block from each district was selected (Siwani and Kanina) randomly. Total six villages namely Jhumpa, Siwani, Barua from block Siwani and villages Kanina, Kareera and Lukhi from block Kanina have been selected randomly. District Bhiwani is situated between 28.19° & 29.05° north latitude and 75.26° and 76.28° east longitude. Mahendergarh district lies between north latitude 27°47' to 28°26' and east longitude 75°56' to 76°51'. A list of farmers having experience of farming of 10 years was prepared with the help of Village Extension Workers (VEW). From each village, 30 farmers were selected, making a sample of 180 respondents. To take observations on rationality of practices, 40 scientists working at KVKs Bhiwani (4) and

Table-1a *Status of identified indigenous plant protection practices based on farmer response about innovation characteristics*

SN	Practice	Profitability		Practicability		Simplicity- complexity		Sustainability		Combined	
		Mean score	Category	Mean score	Category	Mean score	Category	Mean score	Category	Mean score	Category
A)	Disease										
1	Soaking of pearlmillet seeds in salt solution to control the ergot disease.	1.28	Low	3	High	3	High	3	High	2.57	High
2	Neem oil is sprayed to control powdery mildew in black gram crop.	1.09	Low	1.21	Low	1.19	Low	2.97	High	1.63	Low
B)	Insects										
1	Small trenches are dug around the field and in the field at various places to control hairy catter pillar.	2.72	High	1.92	Medium	2.71	High	3	High	2.59	High
2	Deep summer ploughing is done to control the various insects like pod borer and various soil born diseases.	2.43	High	2.46	High	2.76	High	2.98	High	2.66	High
3	Dusting of ash at germination stage to control the house cricket and locust in mustard field.	2.2	Medium	2.19	Medium	2.75	High	2.84	High	2.49	Medium
4	Preparing the *pakoras* and *gulgulas* with the mustard oil in the field to reduce the attack of disease.	1.02	Low	1.6	Low	2.05	Medium	3	High	1.92	Medium
5	Garlic extract, neem and aakor dhtura extract are used for seed treatment to control various disease and termite attack.	1.05	Low	1.09	Low	1.16	Low	1.92	Low	1.31	Low
C)	Stored pest										
1	Storing black gram by mixing them with sand.	3	High	3	High	3	High	3	High	3	High
2	Before storage the seeds of pearlmillet are properly dried in sun.	2.94	High	3	High	2.92	High	3	High	2.97	High
3	Disinfect the storage structure with smoke of dung cake and neem leaves before storing the grains.	1.92	Medium	2.83	High	1.91	Medium	2.11	Low	2.19	Medium
4	Putting the tarcoal sheets in between storage structure walls and under its floor to protect the grains from moisture.	1.42	Low	1.67	Low	1.51	Low	2.13	Low	1.68	Low
D)	Birds										
1	Clapping of hands is done to drive away the birds.	2.02	Medium	1.15	Low	3	High	3	High	2.29	Medium
2	Fixing a human effigy prepared from straw and old cloths in the field to scare the birds and animals.	2.5	High	2.94	High	3	High	3	High	2.86	High
3	Beating empty iron / plastic drum toward off birds.	2.48	High	1.4	Low	3	High	3	High	2.47	High
4	Pieces of polythene sheet / metallic ribbon are tied on a pole and fixed in the field to produce sound to scare the birds.	2.72	High	2.78	High	2.97	High	2.89	High	2.84	High

Table-1b *Categorization of attributes of innovation on the basis of farmer's response*

SN	Attributes	High	Medium	Low
1	Profitability	7	3	5
		B1, B2, C1, C2, D2, D3, D4	B3, C3, D1	A1, A2, B4, B5, C4
2	Practicability	7	2	6
		A1, B2, C1, C2, C3, D2, D4	B1, B3	A2, B4, B5, C4, D1, D3
3	Simplicity	10	3	3
		A1, B1, B2, B3, C1, C2, D1, D2, D3, D4	B4, C3	A2, B5, C4
4	Sustainability	12	0	3
		A1, A2, B1, B2, B3, B4, C1, C2, D1, D2, D3, D4		B5, C3, C4

** Figures represent the code numbers of indigenous plant protection practices*

Table-2a *Status of identified indigenous plant protection practices based on scientist response about innovation characteristics*

SN	Practice	Profitability		Practicability		Simplicity complexity		Sustainability		Combined	
		Mean score	Category	Mean score	Category	Mean score	Category	Mean score	Category	Mean score	Category
	Disease										
1	Soaking of pearlmillet seeds in salt solution to control the ergot disease.	2.98	High	3	High	3	High	3	High	2.99	High
2	Neem oil is sprayed to control powdery mildew in black gram crop.	1.1	Low	1.08	Low	2.13	Medium	3	High	1.83	Low
	Insects										
1	Small trenches are dug around the field and in the field at various places to control hairy catter pillar.	2.98	High	2.89	High	2.74	High	3	High	2.9	High
2	Deep summer ploughing is done to control the various insects like pod borer and various soil born diseases.	2.78	High	2.77	High	2.72	High	3	High	2.82	High
3	Dusting of ash at germination stage to control the house cricket and locust in mustard field.	2.2	Medium	2.35	High	2.75	High	2.98	High	2.57	High
4	Preparing the *pakoras* and *gulgulas* with the mustard oil in the field to reduce the attack of disease.	1.04	Low	1.21	Low	2.12	Medium	2.78	High	1.79	Low
5	Garlic extract, neem and aakor dhtura extract are used for seed treatment to control various disease and termite attack.	1.04	Low	1.02	Low	1.92	Medium	2	Low	1.49	Low
	Stored pest										
1	Storing black gram by mixing them with sand.	3	High	3	High	3	High	3	High	3	High
2	Before storage the seeds of pearlmillet are properly dried in sun.	2.97	High	3	High	3	High	3	High	2.99	High
3	Disinfect the storage structure with smoke of dung cake and neem leaves before storing the grains.	2.38	High	2.47	High	2.58	High	2.78	High	2.55	High
4	Putting the tarcoal sheets in between storage structure walls and under its floor to protect the grains from moisture.	1.76	Medium	2.32	Medium	2.52	High	2.63	Medium	2.31	Medium
	Birds										
1	Clapping of hands is done to drive away the birds.	2.09	Medium	1.23	Low	3	High	3	High	2.33	Medium
2	Fixing a human effigy prepared from straw and old cloths in the field to scare the birds and animals	2.48	High	2.92	High	3	High	3	High	2.85	High
3	Beating empty iron / plastic drum toward off birds.	2.68	High	1.5	Low	3	High	3	High	2.55	High
4	Pieces of polythene sheet / metallic ribbon are tied on a pole and fixed in the field to produce sound to scare the birds.	2.77	High	2.83	High	3	High	2.79	High	2.85	High

Table-2b *Categorization of attributes of innovation on the basis of scientists' response*

SN	Attributes	High	Medium	Low
1	Profitability	9	3	3
		A1, B1, B2, C1, C2, C3, D2, D3, D4	B3, C4, D1	A2, B4, B5
2	Practicability	9	1	5
		A1, B1, B2, B3, C1, C2, C3, D2, D4	C4	A2, B4, B5, D1, D3
3	Simplicity	12	3	0
		A1, B1, B2, B3, C1, C2, C3, C4, D1, D2, D3, D4	A2, B4, B5	
4	Sustainability	13	1	1
		A1, A2, B1, B2, B3, B4, C1, C2, C3, D1, D2, D3, D4	C4	B5

**Figures represent the code numbers of indigenous plant protection practices*

Table-3 *Comparison of indigenous plant protection practices with their respective scientific technologies.*

SN	Practice	Equally suitable	Suitable	Not suitable	Total score	Mean score
	Disease					
1	Soaking of pearlmillet seeds in salt solution to control the ergot disease.	35 (87.5)	3 (7.5)	2 (5.0)	113	2.83
2	Neem oil is sprayed to control powdery mildew in black gram crop.	---	10 (25.0)	30 (75.0)	50	1.25
	Insects					
1	Small trenches are dug around the field and in the field at various places to control hairy catter pillar.	40 (100.0)	---	---	120	3
2	Deep summer ploughing is done to control the various insects like pod borer and various soil born diseases.	38 (95.0)	2 (5.0)	---	118	2.95
3	Dusting of ash at germination stage to control the house cricket and locust in mustard field.	15 (37.5)	10 (25.0)	15 (37.5)	80	2
4	Preparing the *pakoras* and *gulgulas* with the mustard oil in the field to reduce the attack of disease.	---	3 (7.5)	37 (92.5)	43	1.07
5	Garlic extract, neem and aakor dhtura extract are used for seed treatment to control various disease and termite attack.	---	7 (17.5)	33 (82.5)	47	1.17
	Stored pest					
1	Storing black gram by mixing them with sand.	40 (100.0)	---	---	120	3
2	Before storage the seeds of pearlmillet are properly dried in sun.	38 (95.0)	2 (5.0)	---	118	2.95
3	Disinfect the storage structure with smoke of dung cake and neem leaves before storing the grains	7 (17.5)	23 (80.0)	10 (25.0)	77	1.93
4	Putting the tarcoal sheets in between storage structure walls and under its floor to protect the grains from moisture.	4 (10.0)	25(62.5)	11 (27.5)	73	1.83
	Birds					
1	Clapping of hands is done to drive away the birds.	1 (2.5)	37 (92.5)	2 (5.0)	79	1.98
2	Fixing a human effigy prepared from straw and old cloths in the field to scare the birds and animals	12 (30.0)	28 (70.0)	10 (25.0)	102	2.55
3	Beating empty iron / plastic drum toward off birds.	3 (7.5)	36 (90.0)	1 (2.5)	82	2.05
4	Pieces of polythene sheet / metallic ribbon are tied on a pole and fixed in the field to produce sound to scare the birds.	10 (25.0)	30 (75.0)	---	90	2.25

The figures in parenthesis indicates percentage of respondent

Mahendergarh (4), Department of Agronomy (10), Entomology (12) and Plant Pathology (10), Chaudhary Charan Singh Haryana Agricultural University, Hisar were selected purposively. The data pertaining to study have been collected in two phases. In the first phase, an in-depth discussion was held with some informal key questions to identify the IPPP. Also, the IPPP identified by the researchers were taken up from literature and discussed with the dry land farmers through unstructured depth interviews. An explanation was sought on the IPPP screened out from the past researches. In the second phase of data collection, the degree of prevalence of the components of IPPP with the farmers as well as the logic for the same was ascertained through a well-structured interview schedule. A variable can be defined as a thing which is observed and that is of such a nature that each single observation can be defined into one and only one of a number of mutually exclusive classes [4]. Measurement of dependent variables: Identification, Innovation characteristics, Profitability, Practicability, Simplicity–complexity, Sustainability. Measurement of independent variables: Age, Education, Social participation, Mass media exposure, Extension contact, Socio-economic status, Innovativeness, Risk orientation, Scientific orientation, Fatalism, Localities – cosmopoliteness, Farming experience. The data collected were transmitted on the master sheets indicating various aspects of the phenomena and were put to statistical analysis. Frequency distribution, percentages, means, total choice score, equi-distance method etc. were worked out for the purpose of analysis and interpretation of data.

Results

Personal attributes of farmers

The study indicated that majority of the respondents were of old age (67.78%), had primary to metric education(39.45 to 33.33%), with low to medium levels in mass media exposure(59.44 to 30.56%), extension agency contact (35 to 38.89%), innovativeness (48.33%), fatalism (45.00%), rational orientation (62.78%) and scientific orientation (53.33%) whereas majority of them having low social participation (93.33%), medium risk orientation(65.56%) and cosmopoliteness (76.11%), medium to high level of socio- economic status (56.67 to 35.00%), their farming experience was almost equally distributed among all the three categories. The main crops grown by them are wheat, bajra, gram, mustard, cotton and sorghum.

Innovation characteristics status of identified plant-protection practices

In agriculture the sustainability of any practice is based on the innovation characteristics of that identified indigenous plant protection practice. The response from farmers as well scientists were obtained for identified practices and presented as under:

Farmers response

The data presented in [Table-1a,1b] shows that out of 15 identified plant protection practices only 7 of them highly profitable, 7 were found highly practicable, 10 were considered highly simple and 12 were identified as highly sustainable. Whereas only 3 had medium level of profitability, 2 had medium level of practicability, 2 were medium level of simplicity and none had found medium level of sustainability. Moreover, the identified practices had low level of profitability; practicability, simplicity and sustainability were 5, 6, 3 and 3 only, respectively. Since the farmers themselves placed them in low category on the basis of the pooled attribute score and were given low priority while finding their scientific rationality, should not be followed. However, since some farmers were found practicing these practices also, an extension programme need to be launched to discourage the farmers from practicing these practices, till such time scientists are able to come out with research-based rationality level of these practices.

Scientists response

Data in [Table-2a,2b] revealed that as many as 10 practices were found placed in high category on the basis of pooled weighted mean score of all the four attributes of innovation characteristics. Scientists reported only 9 practices were found highly profitable, 9 were reported highly practicable, 12 were considered highly simple and 13 were identified as highly sustainable. Whereas only 3 had medium level of profitability, 1 was found medium level of practicability, 3 were medium level of simplicity and 1 had medium level of sustainability. However, identified practices had low level of profitability; practicability and sustainability were 3, 5 and 1, respectively. The results show that as many as five practices were found placed in high category on all the four attributes *viz*., profitability, practicability, simplicity-complexity and sustainability. Similarly, two practices were found placed in low category and not a single practice was found in medium category for all the four attributes of innovation characteristics. Hence those practices which were obtained low level innovation in all the four characteristics should not be continued on farmer's field as these practices are not supported by the scientists and not even by the farmers. In any type of farming, it would be better to follow only those practices which are having high level of innovation characteristics status. [3, 9,12] were also worked on indigenous practices and reported various agricultural practices on different aspects of farming.

Comparative views of indigenous plant-protection practices with their respective scientific technologies

All the scientists (100%) of sample found three practices *i.e.* small trenches are dung around the field, storing black gram by mixing them with sand were equally suitable with their respective scientific technologies. For practices soaking of pearl millet seeds in salt solution to control the ergot disease, deep summer ploughing is done to control the various insects like pod borer and before storage the seeds of pearl millet are properly dried in sun, more than 80 percent of the scientists perceived them equally suitable with their respective, scientific technologies. More than 75 percent of the scientists reported the practices *viz*. neem oil is sprayed to control powdery mildew in black gram crop, preparing the pakoras and gulgulas

with the mustard oil in field, are not suitable with their respective scientific technologies. Since farming in dry land area is a risky affair, the farmers have been continuously undertaking a variety of experiments in farming over centuries and the results of which have accumulated as the indigenous practices. In the era of fastly changing technology, it is imperative to take the scientists' views about these identified indigenous technologies. For this purpose, the scientists are requested to give their judgment in the light of scientific recommendation regarding these identified 15 indigenous technologies on three-point continuum of 'equally suitable', 'suitable' and 'not suitable'.

Discussion

Despite the traditional feeling attitude of farmers about this own local practice, we could observe that majority of plant protection practices are rated as highly profitable, practical and sustainable by the scientists. Soaking of pearl millet seeds in salt solution to control the ergot disease was perceived less profitable by farmers while scientists perceived it highly profitable. Further, analysis of data showed that scientists recommended this practice but farmers did not accept it as an effective method to control disease. This might be due to farmer's misconception regarding salt solution that it reduces the seed germination. The practice of spraying neem (*Azadirachta indica*) oil to control powdery mildew in black gram crop was observed as less profitable, practical and simple both by farmers and scientists. Other studies also confirm such practices and sustainable. Small trenches digging around and in the field at various places to control hairy caterpillar may help to make barrier and larvae of hairy caterpillar fall down in tranches; and they can be destroyed easily. Deep summer ploughing during summer to control the various insects like pod borer and other soil born diseases, helps to expose spores of different soil born diseases and eggs of pod borer. Dusting of ash at germination stage in controlling the house cricket and locust in mustard field was found to be sustainable and in line with the results reported by [8,12]. Garlic (*Allium sativum*) extract, neem and aak (*Calotropis gigantean*) or dhtura (*Datura alba*) extract are used for seed treatment to control various disease and termite attack were observed to be less practical and sustainable. The above finding contradicted with the finding of [8,12]. Garlic (*Allium sativam*) extract, neem and aak (*Calotropis gigantean*) or dhatura (*Datura alba*) extract are used for seed treatment to control various disease and termite attack was perceived less effective and sustainable by both farmers and scientists [1]. Confirmed that neem leaves had possessed insect repellent properties. The identified indigenous practices storing black gram by mixing them with sand; before storage the seeds of pearl millet are properly dried in sun, were perceived sustainable by the farmers and scientists both. These results find support from findings of other scholars' too [10-13]. The practice of disinfect the storage structure with smoke of dung cake and neem leaves before storing grains to protect them from insects was perceived less effective by farmers. However, the scientists found effective. Putting the tar-coal sheets in between storage structure walls and under its floor to protect the grains from moisture was viewed as ineffective by both categories of respondents which is in line with [6 and 7]. On further examination it was found that there is possibility of damage to stored grains in summer due to leakage of the tar-coal.

Conclusion

From foregoing study, it has been concluded that most of the recorded ITKs on plant protection practices are simple and sustainable. Out of 15 identified indigenous plant protection practices, Farmers reported that 7 practices were highly profitable, 7 were found highly practicable, and 10 were considered highly simple and 12 were identified as highly sustainable. Whereas, the identified practices which were having low level of profitability, practicability, simplicity and sustainability were 5, 6, 3 and 3, respectively. Scientists found that 9 practices were highly profitable, 9 were reported highly practicable, 12 were considered highly simple and 13 were identified as highly sustainable. However, 3, 5, 0 and 1 practice had low level of profitability, practicability, simplicity and sustainability, respectively.

Application of research: The study has explicitly brought out the need for an education programme for dry land farmers. To be effective, this educational programme has to include a variety of informal teaching methods, including short duration training programmes, demonstrations, meetings and discussion sessions besides utilizing maximum potential of the mass media for popularizing the rational identified practices. Moreover, high profitable, practicable, simple and sustainable practice should promote and other practices should be discontinued.

Research Category: Extension Education

Abbreviations: ITK- Indigenous traditional knowledge

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