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A SCALE TO MEASURE PERCEPTION OF FARMERS ON PESTICIDES USE BEHAVIOUR

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ABSTRACT

A scale was developed to measure the perception of farmers about pesticides use behaviour by following the Likert's summated rating scale was. Based on the review of literature and discussion with the experts, 81 statements were prepared on dimensions. Relevancy rating was sent to 250 scientists and extension specialists working in research institutes of Indian Council of Agriculture Research (ICAR), State Agricultural University and development Departments for critical evaluation of statements on five point continuum. Eighty five judges sent in time were analyzed and aggregate of 74 statements were selected by finding the relevancy weightage scores (RWS) equal or more than 0.75 and mean relevancy score of 3.00 were selected for the item analysis. In item analysis the selected statements were administered to 40 farmers in non-sample area in Dharwad district of Karnataka state. Finally a total of 25 statements were selected for the study based on 'r' values (> 1.75) they were included in the final scale. The 'r' value of the scale was found to be 0.91, which was significant at one per cent level indicating the high reliability. The scale developed was found to be reliable and valid, hence it is recommended to use the scale to study pesticide use behaviour

Key words: *perception, pesticide use behaviour, reliability, validity, scale*

INTRODUCTION

Chemical control of pests is a common practice in agriculture.There are more than a thousand pesticides of both chemical and biological nature used around the world to minimize crop losses. Agriculture in developing countries suffers most because of high incidence of various pests.The UN FAO estimates that in developing countries, pests, weeds and disease destroy about 40 per cent of crops while they are still in the fields and 6 to 7 per cent of them after the harvest. In Africa and Asia, the pre-harvest losses are estimated at 50 per cent. Oerke, (2006) and Edwards (1969) have reported global crop losses due to pests between one-third and one-half of the attainable crop production, with crop losses in developing countries at the higher side.

Perceptions of pesticide efficacy were found to play a major role in the behaviour of farmers towards the use of pesticides and the adoption of alternative methods of pest control such as IPM. Evidently, farmers' perceptions of pesticide efficacy should receive special attention by extension services as a critical point of intervention for rational pesticide use and adoption of IPM programs. Besides, decisions on pest control are quite subjective and may depend on several characteristics of farmers, including personal beliefs, perceptions, and preferences. (Grieshop *et al.*,1988) The most important constraint faced by vegetable growers was found as "Non availability of information in time as per recommended dose of pesticides" and the least important constraint faced by vegetable growers was found as "Non-availability of plant protection chemicals at village place. Vihariya *et al* (2019). The present study is prepared to develop a scale to measure perception of farmers on pesticide use. The perception scale on pesticides use behavior developed as a part of the study eighty five judges sent in time were analyzed and aggregate of 74 statements were selected by finding the relevancy weightage scores (RWS) equal or more than 0.75 and mean relevancy score of 3.00 were selected for the item analysis. In item analysis the selected statements were administered to 40 farmers in non-sample area in Dharwad district of Karnataka state. Finally a total of 25 statements were selected for the study based on 'r' values (> 1.75) they were included in the final scale. The 'r' value of the scale was found to be 0.91, which was significant at one per cent level indicating the high reliability. The scale developed was found to be reliable and valid, hence it is recommended to use.To study, pesticide use behaviour. Hence the present study is prepared to develop a scale to measure perception of farmers on pesticide use. The perception scale on pesticides use behavior developed as a part of the study will be useful for researchers in further measuring the variables in other populations.

OBJECTIVE

To develop the scale to measure perception of farmers about pesticides use behaviour

METHODOLOGY

Likert method of scale development was used to develop scale the steps followed in developing the scale to measure perception of farmers about pesticides use behaviour is presented below ten dimensions were identified.

(1) Identification of dimensions

Based on the review of the past studies and discussion with the specialists in the concerned field. The dimensions including types of pesticides, compatibility, mode of actions, pesticides application ,types of equipment ,toxicity of pesticides, personal protective safety measures, health hazards storage and disposal of pesticide.

(2) Identification of items/statements

2.1. Collection of items /statements

Ninety eight draft statements on the perception of farmers about pesticides use behaviour were formed based on review of literature, researcher's own experience. These statements were carefully edited in the light of 14 criteria suggested by Edward (1969), and 85 statements were selected.

(3) Relevancy weightage

All the statements were subjected to scrutiny by an expert panel to determine the relevancy and screening for inclusion in the final scale. The list of scrutinized 89 statements was sent to a 200 experts to critically evaluate each statement for its relevancy to measure perception of farmers about pesticides use behaviour. The experts were requested to give their response on a five point continuum *viz.,* Most Relevant (MR), Relevant (R), Somewhat Relevant (SR), Less Relevant (LR) and Not Relevant (NR) with scores 5, 4, 3, 2 and 1, respectively for positive statements and scoring was reversed for negative statements.

Eighty nine experts responded in a time span of two months. The relevancy score of each item was ascertained by adding the scores on rating scale for all the 89 experts' responses.Relevancy Percentage (RP), Relevancy Weightage (RW) and Mean Relevancy score (MRS) were worked out for all the 85 items/ statements by using the following formulae.

$$\text{Relevancy Percentage (RP)} = \frac{\text{MR} \times 5 + \text{R} \times 4 + \text{SWR} \times 3 + \text{LR} \times 2 + \text{NR} \times 1}{\text{Maximum possible score (85 X 5 =425)}} \times 100$$

$$\text{Relevancy Weightage (RW)} = \frac{\text{MR} \times 5 + \text{R} \times 4 + \text{SWR} \times 3 + \text{LR} \times 2 + \text{NR} \times 1}{\text{Maximum possible score (85} \times 5 = 425)}$$

$$\text{Mean Relevancy Score (MRS)} = \frac{\text{MR} \times 5 + \text{R} \times 4 + \text{SWR} \times 3 + \text{LR} \times \text{NR} \times 1}{\text{Number of judge's respondent}}$$

The statements having relevancy percentage more than (75.00%) & relevancy weightage more than 0.75 and mean relevancy score more than 3.00 were considered for final selection of statements. By this process, out of 85 statements, 74 statements had relevancy percentage above 75, relevancy weightage above 0.75 and mean relevancy score more than 3.00 and they were isolated in the first stage of screening, suitably modified and rewritten as per the comments of experts. Thus, finally 74 statements (Table.1) were selected after the relevancy test.

(4) Item analysis

The selected 74 statements were subjected to item analysis to demarcate the items (Vinaya *et al.,* 2016). Thus scrutinized statements representing the perception of farmers about pesticides use behaviour to 40 respondents from non sample area of Dharwad taluka of Dharwad district of Karnataka state were pre tested. The respondents were asked to indicate their degree of agreement or disagreement with each statement on a five point continuum *viz*., strongly agree, agree, undecided, disagree and strongly disagree with scores of 5, 4, 3, 2 and 1, respectively and negative statements scores were reversed.

The summated score for the total statements of each respondent was calculated. For each respondent the maximum possible score for 74 statements was 370 and the minimum was 74. The scores of the respondents were then arranged in a descending order. The 25 per cent from highest scores (high group) and 25 per cent from lowest scores (low group) were taken for the item analysis. These responses were subjected to item analysis for selection of the items that constitute the final perception scale.

The critical ratio *of (*t-value) measure, the extent to which a given statement differentiates between the high and low groups of respondents for each statement was calculated

by using the following formula

$$t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\left(\Sigma \bar{X}_H^{\,2} - \frac{(\Sigma[\bar{X}_H])^2}{n}\right) \times \left(\Sigma \bar{X}_L^{\,2} - \frac{(\Sigma[\bar{X}_L])^2}{n}\right)}{n(n-1)}}$$

Where,

$\bar{X}_H$ = The mean score on given statement of the high group

$\bar{X}_L$ = The mean score on given statement of the low group

$\sum X^2_H$ = Sum of squares of the individual score on a given statement for high group

$\sum X^2_L$ = Sum of squares of the individual score on a given statement for low group

n = Number of respondents in each group

t = The extent to which a given statement differentiate between the high and low group.

After calculating the t- values for all the items of the perception scale using the formula, the values of the statements were arranged in descending order from the highest to the lowest and 74 statements were selected from the scale whose values are highest *(*t- values more than 1.75), for both positive and negative statements.

Table 1: Scale on measure perception of farmers about pesticides use behaviour relevancy percentage, relevancy weightage, mean relevancy

Sr. No.	Statements	R P	RW	MRS
1	Pest can be controlled by organic methods	82.12	0.82	4.11
2	Specific weedicide should be used for a specific crops/weeds	90.35	0.90	4.52
3	For disease we have to use fungicides/bactericides only Insects are killed by pesticides	81.65	0.82	4.08
4	The type of pesticide we use should based on the type of pest/disease.	93.88	0.94	4.69
5	Contact type of insecticides are useful only for biting and chewing types of insects	82.59	0.83	4.13
6	Systemic types of pesticides are useful only for to control the sucking pests	84.71	0.85	4.24
7	For fungal diseases we should spray systematic or contact type	82.12	0.82	4.11
8	Weedicides are also two type systematic and contact	80.00	0.80	4.00
9	Combining two pesticides is harmful	76.00	0.76	3.80
10	Two pesticides can be combined if they are comparable	86.59	0.87	4.33
11	Insecticides and fungicides can be mixed and used	75.06	0.75	3.75
12	We should never mix more than one insecticides	73.88	0.74	3.69
13	Tonics and nutrients can be mixed with pesticides for sprayer	75.53	0.76	3.78
14	Mixing insecticides and fungicide will be less effective	71.53	0.72	3.58
15	Before mixing any chemical pesticide we should check with compatibility chart	90.59	0.91	4.53
16	Combining different pesticides and nutrients will lose its original content	76.47	0.76	3.82
17	Treating seeds/seedling with pesticide control sucking pests	84.94	0.85	4.25
18	Pre emerging spray should be used on the day of sowing.	77.88	0.78	3.89
19	Systemic pesticides goes into the system of the plant hence damage the insect when they suck the sap	90.82	0.91	4.54
20	Systemic pesticides will also harm biting type of insects	81.65	0.82	4.08
21	Weeds like kupras and cynodon are controlled by only systematic weedicide	73.18	0.73	3.66
22	We should spray pesticides in the direction of wind	89.65	0.90	4.48
23	Spraying in the morning or late evening is more effective	95.29	0.95	4.76
24	Proper concentration should be maintained as per recommendation	95.29	0.95	4.76
25	Continuous sprayers of pesticides with higher concentration develop resistance among pests.	88.24	0.88	4.41

Sr. No.	Statements	R P	RW	MRS
26	We should use different nozzles for spraying pesticide and weedicide	91.53	0.92	4.58
27	Concentration depends upon the type of sprayer	74.35	0.74	3.72
28	Battery operated sprayers saves time energy and money	90.12	0.90	4.51
29	we should use different sprayers for weedicide spray	79.53	0.80	3.98
30	we should use gutter sprayers in tall plants such as fruits crops	85.65	0.86	4.28
31	we should clean sprayers before and after using to avoid contamination	92.71	0.93	4.64
32	we should use nozzles according to crop growth /canopy/leaf area	90.35	0.90	4.52
33	High volume sprayers requires less concentration	76.94	0.77	3.85
34	Tractor mounted sprayers are more effective than the knapsack sprayers.	78.59	0.79	3.93
35	Less toxic pesticides should be used at initial stage of the crop growth	84.71	0.85	4.24
36	High toxic pesticides /strong toxic pesticides should be used later stage of the crop	76.94	0.77	3.85
37	Pesticides are harmful to human beings or non-target organisms	90.35	0.90	4.52
38	Pesticides are harmful to beneficial organisms like pollinators, predators, parasitoids and domestic animals	92.00	0.92	4.60
39	The toxicity of a pesticide is dependent upon types and concentration	89.88	0.90	4.49
40	We can easily notice the toxicity by seeing label colors	90.59	0.91	4.53
41	Red color triangle with Skull Crossbones and POISON label indicates Extremely toxic	92.47	0.92	4.62
42	Yellow color triangle with POISON label indicates Highly toxic	87.29	0.87	4.36
43	Blue color triangle with DANGER label indicates moderately toxic	88.94	0.89	4.45
44	Green color triangle with CAUTION label indicates slightly toxic	89.88	0.90	4.49
45	We should Wear PPE such as gloves, mask, apron, goggle, facial shield etc. reduces pesticide contact	92.94	0.93	4.65
46	Covering the face with cloth towel, wearing long sleeved shirts, reduces pesticide contact	91.53	0.92	4.58
47	We should take bath after spraying of the pesticides	92.24	0.92	4.61
48	It is expensive and inconvenient to use PPE	76.24	0.76	3.81
49	Washing face and hands will clean/wash away all pesticides particles on the body	86.12	0.86	4.31
50	We should avoid taking food immediately after spraying	88.94	0.89	4.45
51	Spraying without proper face cover may lead in to poisoning and death	87.06	0.87	4.35
52	Pesticide induced human health effects are acute and chronic	90.35	0.90	4.52
53	Pesticides will cause serious diseases.	87.29	0.87	4.36
54	Long term effects (chronic) of pesticide exposure include neurological problems, cancers, birth defects,	90.59	0.91	4.53
55	fetal death, and neurodevelopment disorder	86.35	0.86	4.32
56	Headache, itching, tiredness, dizziness, Dizziness, vomiting or blurred vision or skin sores after spraying of pesticides are common	92.24	0.92	4.61
57	We should not use empty pesticide containers for household propose as they may cause health hazards	93.41	0.93	4.67
58	Pesticides affects only person who is engaged in spraying	71.29	0.71	3.56
59	Pesticide particles float in air and cause problem to animals and human beings Our nose filter all pesticide particles and cause no harm	82.82	0.83	4.14
60	We should store pesticides in locked chamber or away from children's	93.18	0.93	4.66
61	We should store the pesticides away from food items and water sources	95.53	0.96	4.78
62	We should store pesticides in their original container with label intact	92.24	0.92	4.61
63	We should not dispose empty pesticide in water bodies (well, rivers ,farm pond)	91.53	0.92	4.58

Sr. No.	Statements	R P	RW	MRS
64	We should not dispose empty pesticides into FYM pit	91.06	0.91	4.55
65	We should collect all empty containers at one place and hand it over to recycler or burry them	89.65	0.90	4.48
66	Leaving pesticide bottles or cover in the field cause soil/ water pollution	90.12	0.90	4.51
67	Pesticide will directly harm microbial population of the soil	90.12	0.90	4.51
68	Over use of pesticides will result in more residue in food and make unfit for consumption	93.65	0.94	4.68
69	Spraying high volume sprayers cause lot of air pollution	90.12	0.90	4.51
70	Continuous application of pesticides to the soil will pollute the ground water	94.12	0.94	4.71
71	Pesticides extensively kill beneficial insects	87.53	0.88	4.38
72	Use of more weedicide will reduce microbial population in the soil	85.18	0.85	4.26
73	Any pesticide ultimately cause ill effects on the environment	88.94	0.89	4.45
74	Organic methods are best for today's agriculture	91.06	0.91	4.55

Items generated with relevancy percentage (RP), relevancy weightage (RW) and mean relevancy scores (MS)

Selection of perception statements for final Scale

After computing "t" value for all the items, 25 statements with highest "t" value equal to or greater than 1.75 were selected. The thumb rule of rejecting items with 't' value less than 1.75 was followed as suggested by, Edward (1957). As per the thumb rule selection of items to be retained in the scale, includes the scales with highest discriminating values excluding the scales with poor discriminating ability and questionable validity. Thus, 25 statements were retained for consideration in the final scale based on the following norms:

i. The 't' value should be more than 1.75

ii. The statement should present a new idea *(*the idea not overlapping with that expressed other)

iii. The statement should be simply worded and brief.

(5) Reliability and validity of perception scale

The scale developed was further standardized by establishing its reliability and validity. Reliability is the accuracy or precision of measuring instrument. Split-Half method was followed, to know the reliability of the scale.

Split-Half methodology

The 25 selected perception items were divided into two halves by odd-even method. The two halves were administered separately to 20 farmers in a non-sample area. The scores were subjected to product moment correlation test in order to find out the reliability of the half-test. The half-test reliability coefficient (r) was 0.91, which was significant at one per cent level of probability. Further, the reliability coefficient of the whole test was computed using the Spearman-Brown prophecy formula given below.

$$r_{1/2} = \sqrt{\frac{n\,(\sum XY - (\sum X)\,(\sum Y)}{(n\sum X^2 - (\sum X)^2)\,(n\sum Y^2 - (\sum Y)^2}}$$

Where,

$\sum X$ = Sum of the scores of the odd number items

$\sum Y$ = Sum of the scores of the even numbers items

$\sum X^2$ = Sum of the squares of the odd number items

$\sum Y^2$ = Sum of the squares of the even number items

n = Number of respondents

The whole test of the scale was .913, which was highly significant at one per cent level indicating the high reliability of the scale.

(6) Content validity of the perception scale

The validity of the scale was established through content validity *i.e.*, the representativeness or sampling adequacy of the content of a measuring instrument. The scale satisfies both these criteria as the clause of universe of statements that could be made about pesticides use behaviour formulated from the standards and also in consultation with experts. Care was taken for obtaining a fair degree of content validity. The calculated "t" value being significant for all the finalized statements of the score indicated that the perception statements of the scale have discriminating values. Hence, it seems reasonable to accept the scale as a valid measure of the perception .

RESULTS AND DISCUSSION

Administration and scoring of perception scale

The final scale consisted of 25 statements (Table 2). The responses had to be recorded on a five point continuum representing strongly agree, agree, undecided, disagree and strongly disagree with scores of 5, 4, 3, 2, and 1, respectively for positive statements and vice versa for negative statements. The perception score on this scale ranges from a minimum of 25 to maximum of 125.

Table 2 : Scale on measure perception of farmers about pesticides use behavior 't' test

Sr. No.	Items	't' value
I	**Types of pesticides**	
1	Pest can be controlled by organic methods	1.76
2	The type of pesticide we use should be based on the type of pest/disease.	2.18
3	Systemic pesticides are useful only for to control the sucking pests	1.98
II	**Compatibility**	
4	Combining two pesticides is harmful *	1.93
5	Mixing insecticides and fungicide will be less effective	3.08
6	Combining different pesticides and nutrients will lose its original content*	2.57
III	**Mode of actions**	
7	Systemic pesticides goes into the system of the plant hence damage the insect when they suck the sap	2.18
8	Weeds like Cyperus and cynodon are controlled by only systematic weedicide	1.89
IV	**Pesticides application**	
9	Spraying in the morning or late evening is more effective	3.60
10	We should use different nozzles for spraying pesticide and weedicide	3.08
V	**Types of equipment**	
11	We should use gutter sprayers in tall plants such as fruits crops	2.12
12	We should use nozzles according to crop growth /canopy/leaf area	3.27
VI	**Toxicity of pesticides**	
13	Pesticides are harmful to beneficial organisms like pollinators, predators, parasitoids and domestic animals*	3.08
14	Red color triangle with Skull Crossbones and POISON label indicates Extremely toxic	1.92
VII	**Personal protective Safety measures**	
15	It is expensive and inconvenient to use PPE*	3.08
16	Washing face and hands will clean/wash away all pesticides particles on the body*	1.92
VIII	**Health hazards**	
17	Headache, itching, tiredness, dizziness, vomiting or blurred vision or skin sores after spraying of pesticides are common	1.91
18	Pesticides affects only person who is engaged in spraying*	5.01
19	Pesticide particles float in air and cause problem to animals and human beings Our nose filters all pesticide particles and cause no harm	2.57
IX	**Storage and disposal of pesticide**	
20	We should not dispose empty pesticides into FYM pit	3.28
21	We should collect all empty containers at one place and hand it over to recycler or burry them	4.11
22	Leaving pesticide bottles or cover in the field cause soil/ water pollution*	2.18
X	**Environment effects**	
23	Continuous application of pesticides to the soil will pollute the ground water*	4.24
24	Use of more weedicide will reduce microbial population in the soil*	4.98
25	Organic methods are best for today's agriculture	4.24

Note * Negative statement

Table 3 : Perception of farmers about pesticides use sent to the expert for their relevancy

Sr. No.	Items	MR	R	UD	SWR	NR
I	**Types of pesticides**					
1	Pest can be controlled by organic methods					
2	The type of pesticide we use should be based on the type of pest/disease.					
3	Systemic pesticides are useful only for to control the sucking pests					
II	**Compatibility**					
4	Combining two pesticides is harmful *					
5	Mixing insecticides and fungicide will be less effective					
6	Combining different pesticides and nutrients will lose its original content*					
III	**Mode of actions**					
7	Systemic pesticides goes into the system of the plant hence damage the insect when they suck the sap					
8	Weeds like Cyperus and cynodon are controlled by only systematic weedicide					
IV	**Pesticides application**					
9	Spraying in the morning or late evening is more effective					
10	We should use different nozzles for spraying pesticide and weedicide					
V	**Types of equipment**					
11	We should use gutter sprayers in tall plants such as fruits crops					
12	We should use nozzles according to crop growth /canopy/leaf area					
VI	**Toxicity of pesticides**					
13	Pesticides are harmful to beneficial organisms like pollinators, predators, parasitoids and domestic animals*					
14	Red color triangle with Skull Crossbones and POISON label indicates Extremely toxic					
VII	**Personal protective Safety measures**					
15	It is expensive and inconvenient to use PPE*					
16	Washing face and hands will clean/wash away all pesticides particles on the body*					
VIII	**Health hazards**					
17	Headache, itching, tiredness, dizziness, vomiting or blurred vision or skin sores after spraying of pesticides are common					
18	Pesticides affects only person who is engaged in spraying*					
19	Pesticide particles float in air and cause problem to animals and human beings Our nose filters all pesticide particles and cause no harm					
IX	**Storage and disposal of pesticide**					
20	We should not dispose empty pesticides into FYM pit					
21	We should collect all empty containers at one place and hand it over to recycler or burry them					
22	Leaving pesticide bottles or cover in the field cause soil/ water pollution*					
X	**Environment effects**					
23	Continuous application of pesticides to the soil will pollute the ground water*					
24	Use of more weedicide will reduce microbial population in the soil*					
25	Organic methods are best for today's agriculture					

Note * Negative statement

Note- Most relevant-Relevant (MR), Undecided (UD), somewhat relevant (SWR) and Not relevant (NR)

The perception level was operational zed as level of perception of the farmers about the pesticide use behaviour. The responses elicited from the farmers were quantified. Results are in line with Nagaraj and Krishnamurthy (2015) The scale developed was found to be reliable and valid. The perception scale developed was administered. The results revealed that 40.00 per cent of paddy growers had high level of perception towards improved production technologies, whereas, 36.67 and 23.33 per cent of paddy growers had medium and low level of perception towards improved production technologies. And Dodiya *et al* (2017) reported that Major input supply constraints reported by Bt. cotton growers were unqualified dealers (81.66%), dealers misleading the farmers (75.83%), poor quality of chemicals (70.83 per cent), non-availability of chemicals in time (70.00%), non-availability of pest resistance varieties of Bt. cotton crop (50.83%) and non-availability of spraying equipments (18.33%) and ranked first, second, third, fourth, fifth and sixth, respectively. Ravi *et al* (2022) also developed scale by using same procedure. A scale to measure core competency of extension field functionaries in land resource inventory based watersheds. Meenu and Pandya (2022) also developed scale by using same procedure. Development of scale on attitude of woman faculties towards professionalism

CONCLUSION

The scale to measure the perception of farmers on pesticide use behaviour was developed following likert method. The scale consists of ten dimensions namely, types of pesticides, compatibility, mode of actions, pesticides application, types of equipment, toxicity of pesticides, personal protective safety measures, health hazards, Storage and disposal of pesticide containers, environment effects.

POLICY IMPLICATION

Perception of farmers on pesticide use behaviour determine their pesticide use.Hence, it is recommended that the state departments to use the scale to ascertain the farmers perception and organise training and other education activities to orient farmers in proper use of pesticides.

CONFLICT OF INTEREST

This is to declare that there is “No conflict of interest” among researcher.

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