Development and standardization of knowledge test to measure the knowledge of farmers on integrated weed management (IWM) practices in major crops in Mahaboobnagar district of Telangana state

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 Received: 13.3.2016/Accepted: 18.7.2016

ABSTRACT

Due to the non-availability of a standardized scale to measure the Knowledge of farmers on integrated weed management (IWM) practices in major crops it was thought necessary to construct a test for the purpose and an attempt was made to develop a test for measuring knowledge of farmers on IWM practices in major crops. Pertinent items were collected covering all aspects of IWM practices. After getting jury's opinion on the items index of item difficulty, index of item discrimination and index of item validity were worked out. To administer the knowledge test a respondent was given one mark for each correct answer and zero for each wrong answer. One hundred twenty one statements were finally selected from 140 statements.

Keywords: Knowledge test; IWM practices; rice; cotton; groundnut; chilli

INTRODUCTION

The knowledge was operationalized for the present study as the level of information possessed on integrated weed management (IWM) by the farmers. A knowledge test was developed with 121 items among the four crops to measure the knowledge of farmers on IWM practices. Each item was measured on two point continuum viz correct and incorrect with score '1' and '0' respectively. The maximum and minimum scores to be obtained were 121 and 0 respectively.

METHODOLOGY

Collection of items: Initially 140 items were collected focusing on various aspects of IWM practices namely manual method, mechanical method, chemical and others followed in rice, cotton, groundnut and chilli crops. Experts in the field of agriculture viz agronomists, scientists of KVKs, DAATTCs and private officials working at the field level were consulted to collect the above 140 items. After screening fine tuning and editing based on the opinion of the concerned scientists 121 items were left. These 121 items were subjected to item analysis to screen some more items based on the opinion of the respondents in non-sample area.

Item analysis: The item analysis was carried out in terms of three indices viz item difficulty index, item discrimination index and point biserial correlation. The index of item discrimination provides information on how well an item discriminates in agreement that is whether an item really discriminates a well-informed respondent from a poorly-informed respondent. Whereas item difficulty index indicates the extent to which an item is difficult.The point biserial correlation provides information on how well item measures or discriminates in agreement with the rest of the test. Pretesting of the items was done as suggested by Conrad (1948). The items were revised and administered to 84 respondents selected for the purpose of pretesting.

Item difficulty index (P): The 121 items consisting of fill in the blanks, Yes/No, True/False and multiple

choice questions were administered to 84 non-sample respondents. The scores '1' for correct response and zero for incorrect response were given.

After computing the total score obtained from all the 84 respondents on 121 items they were arranged in order from highest to lowest based on which the 84 respondents were divided into six equal groups. These groups were labelled as G_1, G_2, G_3, G_4, G_5 and G_6 with 14 respondents in each group. For the purpose of item analysis the middle two groups G_3 and G_4 were eliminated keeping only four extreme groups with high and low scores as suggested by Bloom et al (1956). The index of difficulty was worked out as the percentage of the respondents answering an item correctly. The items with 'p' values ranging from 0.2 to 0.8 were considered for the final selection of the knowledge test.

Item discrimination index (E 1/3): The item discrimination index indicated by 'E 1/3' was calculated by the formula:

$$E\ 1/3 = \frac{(S1 + S2) - (S5 + S6)}{N/3}$$

where S1, S2, S5 and S6 are the frequencies of correct answers in the groups G1, G2, G5 and G6 respectively; 'N' is the total member of respondents of the sample selected for the item analysis that is 84.

The discrimination index varied from 0 to 1. The items with discrimination index ranging from 0.20 to 0.80 were selected for the final test.

Point biserial correlation (r_{pbis}): The main aim of calculating point biserial correlation was to work out the internal consistency of the items ie the relationship of the total score to a dichotomised answer to any given item. In a way the validity power of the item was computed by the correlation of the individual item of preliminary knowledge test calculated by using the formula suggested by Garret (1966) as follows:

$$r_{pbis} = \frac{MP - MQ}{SD}\sqrt{pq}$$

where r_{pbis}= Point biserial correlation, MP= Mean of the total scores of the respondents who answered the item correctly

$$MP = \frac{\text{Sum total of x y}}{\text{Total number of correct answers}}$$

MQ= Mean of the total scores of the respondents who answered the item incorrectly

$$MQ = \frac{\text{Sum total of x - Sum total of x y}}{\text{Total number of wrong answers}}$$

SD= Standard deviation of the entire sample
P= Proportion of the respondents giving correct answer to the item

$$P = \frac{\text{Total number of correct answers}}{\text{Total number of respondents}}$$

q= Proportion of the respondents giving incorrect answer to the item (or) q= 1 - P, X= Total score of the respondent for all items, Y= Response of the individual for the items (correct= 1, incorrect= 0), XY= Total score of the respondent multiplied by the response of the individual to the response (correct= 1, incorrect= 0)

Items having significant point biserial correlation either at 1 or 5 per cent level were selected for the final test of the knowledge.

Representativeness of the test: Care was taken that the test items selected finally covered the entire universe of respondents' knowledge on IWM practices.

Total items selected: Out of 121 items, 90 were finally selected based on items with difficulty level indices ranging from 30 to 80; items with discrimination indices ranging from 0.2 to 0.8 and items having significant point biserial correlation either at 1 or 5 per cent level. Items selected had range of 0.20 and 0.80 proportion as correct. The average of these proportions being equal to (0.80 + 0.20)/2 = 0.50. Thus the finally selected test items comprised 5 types of questions viz True/False, multiple choice, fill in the blanks, Yes/No and one word answer totalling 90. The selected items with P, E1/3 and rpbis values are given in Table 1.

Test-retest reliability: The test was administered to 25 respondents separately with an interval of 15 days. The two sets of knowledge scores obtained by the farmers were correlated. The correlation coefficient (r= 0.83) was highly significant indicating a high degree of dependability of the instrument for measuring knowledge of the farmers.

Validity: The validity of the test items was tested by the method of point biserial correlation (rpbis). The items with highly significant correlation coefficients either at 1 or at 5 per cent level indicated the validity of the items of the knowledge test designed.

Table 1. Respondents in four extreme groups

S/N	Frequency of correct answers of respondents in four extreme groups				Total frequency of correct answers by all six groups	Correct responses (%)	Difficulty index	Discrimination power	Rpbis
	G-1	G-2	G-5	G-6					
1	7	8	6	4	42	50	44.6	0.18	.155NS
2	12	11	3	4	46	54.76	53.6	0.57	.496**
3	8	10	4	5	42	50	48.2	0.32	.284**
4	12	5	6	3	47	55.95	46.4	0.29	.280**
5	7	10	5	5	43	51.19	48.2	0.25	.176NS
6	14	13	4	5	51	60.71	64.3	0.64	.545**
7	14	13	5	2	54	64.29	60.7	0.71	.648**
8	7	11	6	5	51	60.71	51.8	0.25	.246*
9	8	6	10	4	37	44.05	50	0	.021NS
10	8	10	5	8	39	46.43	55.4	0.18	.117NS
11	6	6	5	3	32	38.1	35.7	0.14	.115NS
12	14	11	7	5	50	59.52	66.1	0.46	.463**
13	7	8	3	4	38	45.24	39.3	0.29	.225*
14	13	5	5	3	40	47.62	46.4	0.36	.323**
15	14	12	7	4	58	69.05	66.1	0.54	.509**
16	10	10	5	1	42	50	46.4	0.5	.447**
17	11	7	3	3	34	40.48	42.9	0.43	.447**
18	11	7	6	1	34	40.48	44.6	0.39	.405**
19	11	10	7	5	54	64.29	58.9	0.32	.321**
20	12	9	10	5	52	61.9	64.3	0.21	.236*
21	14	13	6	7	62	73.81	71.4	0.5	.471**
22	10	7	7	5	45	53.57	51.8	0.18	.162NS
23	12	12	6	6	56	66.67	64.3	0.43	.416**
24	7	11	5	2	35	41.67	44.6	0.39	.315**
25	11	9	6	7	51	60.71	58.9	0.25	.248*
26	10	7	7	1	38	45.24	44.6	0.32	.350**
27	8	7	8	2	34	40.48	44.6	0.18	.194NS
28	12	9	5	6	49	58.33	57.1	0.36	.315**
29	12	10	6	6	52	61.9	60.7	0.36	.287**
30	14	13	8	5	64	76.19	71.4	0.5	.513**
31	8	8	8	5	36	42.86	51.8	0.11	.101NS
32	7	6	4	5	34	40.48	39.3	0.14	.120NS
33	12	10	4	1	42	50	48.2	0.61	.530**
34	6	10	9	4	47	55.95	51.8	0.11	.096NS
35	12	14	7	3	53	63.1	64.3	0.57	.538**
36	8	9	3	4	36	42.86	42.9	0.36	.272*
37	12	8	9	4	42	50	58.9	0.25	.253*
38	13	9	4	7	50	59.52	58.9	0.39	.330**
39	13	8	10	8	56	66.67	69.6	0.11	.153NS
40	7	7	5	3	39	46.43	39.3	0.21	.178NS
41	12	11	6	4	52	61.9	58.9	0.46	.381**
42	9	12	9	6	57	67.86	64.3	0.21	.205NS
43	12	9	8	2	45	53.57	55.4	0.39	.383**
44	11	10	6	5	52	61.9	57.1	0.36	.352**
45	8	12	7	4	44	52.38	55.4	0.32	.248*
46	12	11	5	2	49	58.33	53.6	0.57	.541**
47	6	9	8	5	47	55.95	50	0.07	.093NS
48	9	9	5	2	30	35.71	44.6	0.39	.277*
49	12	9	2	3	37	44.05	46.4	0.57	.486**
50	10	8	8	4	47	55.95	53.6	0.21	.237*
51	10	11	5	1	45	53.57	48.2	0.54	.466**
52	14	11	5	2	46	54.76	57.1	0.64	.530**
53	9	9	5	5	43	51.19	50	0.29	.205NS
54	14	10	6	2	51	60.71	57.1	0.57	.547**
55	4	9	8	6	39	46.43	48.2	0.03	.029NS
56	13	10	5	4	50	59.52	57.1	0.5	.421**
57	11	12	6	2	49	58.33	55.4	0.54	.458**
58	8	9	5	3	36	42.86	44.6	0.32	.255*
59	9	11	5	6	48	57.14	55.4	0.32	.231*

60	14	13	7	1	51	60.71	62.5	0.68	.653**
61	12	6	8	3	46	54.76	51.8	0.25	.243*
62	5	12	7	4	48	57.14	50	0.21	.215*
63	10	5	7	4	38	45.24	46.4	0.14	.188NS
64	12	11	4	4	50	59.52	55.4	0.54	.429**
65	11	9	6	1	50	59.52	48.2	0.46	.435**
66	8	9	6	4	43	51.19	48.2	0.25	.230*
67	11	10	7	4	50	59.52	57.1	0.36	.330**
68	9	11	6	3	43	51.19	51.8	0.39	.328**
69	8	12	6	2	51	60.71	50	0.43	.365**
70	8	9	4	4	34	40.48	44.6	0.32	.249*
71	12	12	4	1	50	59.52	51.8	0.68	.616**
72	10	9	5	2	47	55.95	46.4	0.43	.392**
73	11	10	4	2	40	47.62	48.2	0.54	.438**
74	8	8	3	6	43	51.19	44.6	0.25	.164NS
75	12	10	11	5	55	65.48	67.9	0.21	.237*
76	6	10	3	3	29	34.52	39.3	0.36	.283**
77	12	11	5	8	56	66.67	64.3	0.36	.346**
78	11	11	7	6	53	63.1	62.5	0.32	.242*
79	10	9	6	7	44	52.38	57.1	0.21	.110NS
80	9	7	4	2	34	40.48	39.3	0.36	.355**
81	6	11	5	6	43	51.19	50	0.21	.146NS
82	14	8	9	5	51	60.71	64.3	0.29	.317**
83	14	9	6	6	54	64.29	62.5	0.39	.374**
84	9	10	6	5	43	51.19	53.6	0.29	.230*
85	12	10	7	4	53	63.1	58.9	0.39	.387**
86	10	9	4	3	43	51.19	46.4	0.43	.333**
87	12	13	6	3	53	63.1	60.7	0.57	.546**
88	12	9	6	7	43	51.19	60.7	0.29	.228*
89	6	6	3	5	32	38.1	35.7	0.14	.100NS
90	13	12	4	3	46	54.76	57.1	0.64	.549**
91	9	5	3	6	39	46.43	41.1	0.18	.134NS
92	10	7	5	5	40	47.62	48.2	0.25	.247*
93	11	5	6	4	45	53.57	46.4	0.21	.259*
94	8	10	3	8	44	52.38	51.8	0.25	.131NS
95	13	5	2	6	40	47.62	46.4	0.36	.303**
96	11	7	7	3	44	52.38	50	0.29	.326**
97	10	10	6	5	45	53.57	55.4	0.32	.248*
98	10	9	3	7	47	55.95	51.8	0.32	.203NS
99	10	13	6	3	52	61.9	57.1	0.5	.432**
100	9	7	4	8	37	44.05	50	0.14	.078NS
101	12	6	4	4	39	46.43	46.4	0.36	.322**
102	10	13	5	5	54	64.29	58.9	0.46	.455**
103	4	9	2	4	35	41.67	33.9	0.25	.171NS
104	14	10	4	4	41	48.81	57.1	0.57	.435**
105	12	13	3	4	47	55.95	57.1	0.64	.516**
106	9	10	5	0	33	39.29	42.9	0.5	.409**
107	14	12	4	4	47	55.95	60.7	0.64	.550**
108	10	12	5	4	44	52.38	55.4	0.46	.362**
109	6	9	5	0	30	35.71	35.7	0.36	.310**
110	12	8	3	5	39	46.43	50	0.43	.368**
111	10	10	2	4	39	46.43	46.4	0.5	.340**
112	14	12	8	2	49	58.33	64.3	0.57	.558**
113	11	11	3	4	48	57.14	51.8	0.54	.441**
114	10	11	2	4	37	44.05	48.2	0.54	.407**
115	13	12	2	1	44	52.38	50	0.79	.629**
116	11	12	2	3	42	50	50	0.64	.629**
117	13	12	6	6	45	53.57	66.1	0.46	.359**
118	10	9	2	3	33	39.29	42.9	0.5	.369**
119	11	10	2	1	33	39.29	42.9	0.64	.522**
120	8	10	1	3	36	42.86	39.3	0.5	.382**
121	14	12	4	4	51	60.71	60.7	0.64	.546**

*Selected items, NS: Non-significant

Rpbis not calculated for items difficulty index more than 80 and less than 20 and items discrimination index more than 0.8 and less than 0.2

Content validity: The content validity of the knowledge test was derived from a long list of test items representing the whole universe of IWM practices collected from various sources as discussed earlier. It was assumed that the score obtained by administering the knowledge test of this study measured what was intended to. Thus the knowledge test developed in the present study measured the knowledge of farmers on IWM practices as it showed a greater degree of reliability and validity.

Scoring pattern: The selected knowledge test items were presented under different types as Yes/No, multiple choice, one word answers, True/False and fill in the blanks. The correct response to each test item given by a respondent was given a score of '1' and incorrect response a '0' and thus the knowledge score of a respondent was the summation of scores of correctly answered items. The possible knowledge score ranged from 0 to 90.

Administration of the test: The final knowledge test with 90 items was administered to the farmers. Each item in the knowledge test was read out to the respondents in translated version (Telugu) by the investigator and the responses in the form of correct or incorrect answers were recorded. The correct answer was assigned a weightage of '1' and the incorrect of '0'.

Scoring and categorisation: Based on the knowledge scores obtained respondents were grouped into 3 categories by using class interval technique calculated based on maximum and minimum obtained scores.

RESULTS

Out of 121 items, 90 were selected to measure the knowledge of farmers on IWM practices in major crops.

Knowledge of farmers on the recommended IWM practices of rice

A. Indicate the most appropriate answer from the alternatives given under each of the following statements	
1. First weeding is done after how many days of transplanting?	[ ]
a) 30 b) 20 c) 15	
2. How many times weeding is required in rice crop?	[ ]
a) 2 b) 3 c) 1	
3. Which method is used for control of weeds in rice?	[ ]
a) Mechanical b) Biological c) Chemical d) All of them	
4. Name the post-emergence herbicide used in weed control in rice crop.	[ ]
a) Cyhalofop butyl (clincher) b) Bis pyribac sodium c) 2,4-D	
5. How many irrigations are required for rice crop to manage/reduce weed growth?	[ ]
a) 4 b) 5 c) 2 d) continuous	
B. Fill in the blanks with suitable words	
6. The most important stages in rice crop requiring weed control are _____, _____.	
7. The best recommended spacing for reducing weed growth are_____, _____.	
8. Two important weed species found in the rice field are _____, _____ .	
C. Indicate Yes/No for the following statements	
9. Are present day farmers practicing crop rotation in rice?	Yes/No
10. Is rice crop grown in dry areas subjected to water availability?	Yes/No
11. Do weeds compete more for light, nutrients etc with the main crop?	Yes/No
12. Are pre-emergence herbicides used for weed control in rice crop?	Yes/No
13. Are bio-agents used for weed control in rice crop?	Yes/No
14. Is IWM method more suitable for weed control in rice crop?	Yes/No
D. Indicate whether the following statements are True/False	
15. Rice crop is sensitive to weeds up to 20-45 days after sowing.	True/False
16. Pre- and post-emergence herbicides are used to control the weeds.	True/False
17. Most of the farmers are practicing the hand weeding for control of weeds in rice crop.	True/False
E. Answer in one word	
18. How many times hand weeding is practiced in rice crop?	
19. Which method of rice cultivation is the best to reduce the weed competition?	
20. Which type of herbicide is used for control of weeds in rice crop?	
21. Which method of weeding is cost-effective compared to others?	
22. Integrated weed management is also called as _____.	

Knowledge of farmers on the recommended IWM practices of cotton

A. Indicate the most appropriate answer from the alternatives given under each of the following statements

1. First weeding is done after how many days of sowing? [ ]
a) 30 b) 20 c) 15
2. Which method is used for control of weeds in cotton? [ ]
a) Mechanical b) Biological c) Chemical d) All of them
3. Name the pre-emergence herbicide used for weed control in cotton. [ ]
a) Butachlor b) Pendimethalin c) Pyrithiobac sodium
4. Name the post-emergence herbicide used for weed control in cotton. [ ]
a) Paraquat b) Glyphosate c) Quizalofofethyl
5. How many irrigations are required for cotton crop to manage/reduce weed growth? [ ]
a) 4 b) 5 c) 2 d) Continuous

B. Fill in the blanks with suitable words

6. Any two post-emergence herbicides you are using are _____, _____.
7. The best recommended spacing for reduced weed control are _____, _____.
8. Names of the two important weed species found in the cotton field are _____, _____.

C. Indicate Yes/No for the following statements

9. Are present day farmers practicing crop rotation in cotton? Yes/No
10. Is cotton crop grown in dry areas subjected to water availability? Yes/No
11. Are pre-emergence herbicides used to weed control in cotton crop? Yes/No
12. Are bio-agents used for weed control in cotton crop? Yes/No

D. Indicate whether the following statements are True/False

13. While land preparation we should plough two times with plough and use the leveler once. True/False
14. Cotton crop is sensitive to weeds up to 15-45 DAS. True/False
15. Pre- and post-emergence herbicides are used to control the weeds. True/False

E. Answer in one word

16. How many times hand weeding is practiced in cotton crop?
17. Which method of cotton cultivation is the best to reduce the weed competition?
18. Which method of weeding is the best for effective weed control in cotton crop?
19. Which type of herbicide is used to control weeds in cotton crop?
20. Which method of weeding is cost effective compared to others?

Knowledge of farmers on the recommended IWM practices of groundnut

A. Indicate the most appropriate answer from the alternatives given under each of the following statements

1. Which is the recommended spacing for groundnut crop? [ ]
a) 30 x 10 b) 30 x 15 c) 15 x 15
2. How many times weeding is required for groundnut production? [ ]
a) 2 b) 3 c) 1
3. What method is used for control of weeds in groundnut? [ ]
a) Mechanical b) Biological c) Chemical d) All of them
4. Name the pre-emergence herbicide used for weed control in groundnut. [ ]
a) Oxyfluophran b) Pendimethalin c) Fyzolpop pethyl
5. Name the post–emergence herbicide used for weed control in groundnut. [ ]
a) Paraquat b) Glyphosate c) Imazethaphyr
6. How many irrigations are required for groundnut crop to manage/reduce weed growth? [ ]
a) 4 b) 5 c) 2 d) Continuous

B. Fill in the blanks with suitable words

7. The most important stages in groundnut crop requiring weed control are _____, _____.
8. Any two pre-emergence herbicides you are using are _____, _____.
9. Any two post-emergence herbicides your are using are _____, _____.
10. Two types of implements used to weed control in groundnut field are _____, _____.
11. The best recommended spacing for reduced weed control are _____, _____.

C. Indicate Yes/No for the following statements

12. Is groundnut crop grown in dry areas subjected to water availability? Yes/No
13. Do weeds compete more for light, nutrients etc with main crop? Yes/No
14. Are pre-emergence herbicides used for weed control in groundnut crop? Yes/No
15. Is IWM method more suitable for weed control in groundnut crop? Yes/No

D. Indicate whether the following statements are True/False

16. Groundnut crop is sensitive to weeds up to 15-40 DAS. True/False

17. Practicing inter-cultivations in groundnut helps in reducing the weed competition. True/False
18. Pre- and post-emergence herbicides are used to control the weeds. True/False
19. Most of the farmers are practicing the hand weeding for control of weeds in groundnut crop. True/False

E. Answer in one word

20. How many times is hand weeding practiced in groundnut crop?
21. Which method of groundnut cultivation is the best to reduce the weed competition?
22. Which method of weeding is the best for effective weed control in groundnut crop?
23. Which method of weeding is cost-effective compared to others?

Knowledge of farmers on the recommended IWM practices of chilli

A. Indicate the most appropriate answer from the alternatives given under each of the following statements

1. Which method of sowing is used for cultivation of chilli crop? [ ]
a) Transplanting b) Line sowing c) Broadcasting
2. What method is used for the control of weeds in chilli? [ ]
a) Mechanical b) Biological c) Chemical d) All of them
3. Name of the pre –emergence herbicide used for weed control in chilli. [ ]
a) Butachlor b) Pendimethalin c) Alachlor
4. Name of the post–emergence herbicide used for weed control in chilli. [ ]
a) Paraquat b) Glyphosate c) Pendimethalin

B. Fill in the blanks with suitable words

5. The most important stages in chilli crop requiring weed control are _____, _____.
6. Any two post-emergence herbicides you are using are _____, _____.
7. The two types of implements used for weed control in chilli field are _____, _____.
8. The two important weed species found in the chilli field are _____, _____.

C. Indicate Yes/No for the following statements

9. Present day farmers are practicing crop rotation in chilli. Yes/No
10. Chilli crop is grown in dry areas subjected to water availability. Yes/No
11. Weeds compete more for light, nutrients etc with the main crop. Yes/No
12. Pre-emergence herbicides are used for weed control in chilli crop. Yes/No
13. Bio-agents are used for weed control in chilli crop. Yes/No
14. Is IWM method more suitable for weed control in chilli crop. Yes/No

D. Indicate whether the following statements are True/False

15. While preparing land we should plough two times with plough and use leveler once. True/False
16. Chilli crop is sensitive to weeds up to 15-40 DAS. True/False
17. Practicing inter-cultivation in chilli helps in reducing the weeds competition. True/False
18. Pre- and post-emergence herbicides are used to control the weeds. True/False
19. Most of the farmers are practicing the hand weeding for control of weeds in chilli crop. True/False

E. Answer in one word

20. How many times is hand weeding practiced in chilli crop?
21. Which method of chilli cultivation is the best to reduce weed competition?
22. Which method of weeding is the best for effective weed control in chilli crop?
23. Which type of herbicide is used for control of weeds in chilli crop?
24. Which method of weeding is cost-effective compared to others?
25. Integrated weed management is also called as?

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