The Pharma Innovation Journal 2021; SP-10(7): 514-522

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; SP-10(7): 514-522

www.thepharmajournal.com
Received: 23-05-2021
Accepted: 27-06-2021

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A standard test to measure the knowledge of RKVY beneficiaries on production technologies in rice

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Abstract
The present study is conducted to standardize the knowledge test for determining the knowledge of the farmers on recommended production technologies in rice crop under RKVY 120 items of knowledge test pertaining to rice production technologies were collected from knowledge repository and in deliberation with subject experts of Regional Agricultural Research Stations, Krishi Vigyan Kendras, District Agricultural Advisory and Transfer of Technology Centre of Acharya N. G. Ranga Agricultural University (ANGRAU), Guntur, Andhra Pradesh. These items were given to the subject experts for finding out the degree of relevancy of the items. Out of 120 items, 66 items were selected by adopting weighted mean score method. The selected items were pretested in 2 villages i.e. Lankathota and Mekavaripalem (non-sample area) of Krishna district in Andhra Pradesh. To conduct the knowledge test, respondent is given one (1) mark for each correct answer and zero (0) mark for each wrong answer. Based on the response given by the farmers, 44 items were included in the knowledge test using Item Difficulty Index which ranges from 20 to 80, Discrimination index which ranges from 0.2 to 0.8 and Point Biserial Correlation. The reliability of the knowledge test was measured with the help of split half method and reliability coefficient r = 0.83 which implies that this knowledge test is reliable.

Keywords: Broilers, garlic, tulasi, bodyweight, feed conversion ratio, livability

1. Introduction
The central government launched Rashtriya Krishi Vikas Yojana (RKVY) scheme with an aim to provide support to the agricultural sector in achieving 4% annual agriculture growth. RKVY scheme was started in the year 2007 which was later rebranded as Remunerative Approaches for Agriculture and Allied sector Rejuvenation (RAFTAAR) to be implemented for three years till 2019-20. To spur growth in Agriculture and allied sectors, the National Development Council (NDC) in its meeting held on 29th May, 2007 resolved that a special Additional Central Assistance Scheme called Rashtriya Krishi Vikas Yojana (RKVY) is launched, to bring about quantifiable changes in the production and productivity of various components of Agriculture and allied sectors (Anonymous, 2014) [1], The central government is allocating budget to state governments based on state agricultural plans. Accordingly, Government of Andhra Pradesh has identified Acharya N. G. Ranga Agricultural University as one of the nodal agencies to implement the RKVY programme. As part of RKVY, the university has allotted budget to research stations, Krishi Vigyan Kendras and District Agricultural Advisory and Transfer of Technology Centre's (DAATTCs) for conducting research and extension activities in agricultural and horticultural crops especially in rice crop for the benefit of farming community.

Agriculture is a multifaceted enterprise comprising of millions of small and marginal farmers in India. Majority of Indian farmers are resource poor and illiterate, having tiny or no access to present-day contemporary technologies. Information, knowledge and technologies available to millions of rural families determine the success in agriculture and rural development (Sunilkumar *et al*., 2017) [13]. Agriculture, with its allied sectors, is unquestionably the largest livelihood provider in India. Steady investments in technology development, irrigation infrastructure, emphasis on modern agricultural practices and provision of agricultural credit and subsidies are the major factors contributing to agricultural growth.

Rice is the world's second most widely grown cereal crop after wheat, and is the staple food for more than 50 percent of the world's population and is known as "king of cereals". To feed the growing world population, of about 9 billion by the year 2050, the production and productivity of rice has to enhance enormously especially in highly populated developing

countries (Rao *et al.* 2016) [15]. It is one of the most important crops of India and occupies 23.3 percent of gross cropped area of the country. Rice contributes 43 percent of total food grain production and 46 percent of total cereal production (Nareshkumar *et al*., 2019) [7].

Rice cultivation is the classical and traditional occupation for the crores of the people in the world. It is one of the important livelihood options for majority of the poor as well as it is an occupation with export potential. Having such broad avenue for the farming community, rice cultivation is always been treated as esteemed activity by the rice farmers (Deepa., 2019) [5]. India is the second leading producer of rice in the world next to China. In Andhra Pradesh also rice is the principal food crop cultivated throughout the state providing food for its growing population, fodder to the cattle and employment to the rural masses. Rice is the predominant food crop with an area of 23.56 lakh ha in both *kharif* and *rabi* seasons. The production and productivity of rice crop are 137.10 lakh tonnes and 5819 kg ha^{-1} respectively (Anonymous, 2020) [2] and it was considered to be very low. This might be due to the low level of knowledge of farmers on recommended technologies for rice cultivation. With the implementation of RKVY programme in research and extension wings of ANGRAU there was a significant impact on rice farmers in terms of knowledge and adoption of recommended production technologies. To test the impact of RKVY on the gain in knowledge of the farmers on rice production technology this study was conducted. As a part of Ph. D work (2017 to 2020) the researcher wants to test the effect of ANGRAU technologies on gain in knowledge of the farmers on rice production technology. Knowledge of a farmer is the known information or possessed information of farmer towards recommended technologies for rice technologies (Bhavani, *et al*., 2019) [3]. Due to non-availability of proper knowledge test on rice cultivation, it was thought necessary to construct a test for the purpose. Keeping this in view, an attempt has been made to develop a test for measuring the knowledge of farmers towards rice production technology.

2. Materials and Methods

Knowledge is defined as "behaviors and test situations which emphasizes the remembering either by recognition or by the recall of ideas and material on some phenomenon" (Bloom *et al*., 1956) [4]. Knowledge is reflected as the fourth production aspect after labour, land and capital and is predominantly precarious in the agrarian sector. Knowledge is power and makes an individual grow mentally and emotionally. Particularly in this current era of globalization, liberalization and privatization new opportunities and threats are rapidly emerging. Rural people through knowledge empowerment, have to enhance their ability to make a decision in this current situation. A test is a set of questions, each of which has a correct answer, to which the people respond (Roy and Mondal., 2004) [9]. The test was developed by following the process of items analysis. Items were selected by following the steps given below.

2.1 Collection of knowledge items

The content of the test was composed of items asked in the form of questions. The important factors considered for collecting the items for knowledge test was to determine and classify the object to be measured by taking care of the respondents' abilities. Items were collected from different sources like recommendations of Acharya N. G. Ranga Agricultural University through Zonal Research and Extension Advisory Council (ZREAC) proceedings, Vyavasaya Panchangam, information material of Krishi Vigyan Kendras, District Agricultural Advisory and Transfer of Technology Centre's (DAATTC) and recommendations of Regional Agricultural Research Station, Maruteru.

2.2 Judges rating

A total of 120 items were selected representing rice cultivation practices. All the items were administered to 50 scientists of ANGRAU. The items were given in the form of statements to the judges in relevant field for finding out the degree of relevancy of the items to be include in the final schedule or not. The items were selected by adopting weighted mean score method. Crop specialists were selected from Department of Agronomy, Soil Science, Plant Pathology, Entomology and Physiology, Rice Research Unit, Bapatla and Scientists of ARS/RARS, KVK and DAATTC. The scores of each statement was summed up to find out the total score of each statement for all the 50 judges. The statement under most relevant, relevant and least relevant were given weightage 3, 2 and 1, respectively. The mean score assigned to each statement was calculated by using the following formula.

$$\text{Mean score} = \frac{\text{Total score of each statement}}{\text{Total no of Judges}}$$

After calculating the mean score for all the items, overall mean score was calculated by using the following formula.

$$\text{Overall mean score} = \frac{\text{Total score of all statement for all the judges}}{\text{Total no of statements x total number of judges}}$$

The overall mean score was found to be 2.48. The items having mean score value more than or equal to 2.48 were selected for the construction of Knowledge Test (Table-1)

Table 1: Mean score values of knowledge test items pertaining to rice technology

S. No.	Statement	Mean score
1	Recommended Rice varieties for the Godavari zone are MTU 1010, MTU 1001, BPT 5204, MTU 7029, MTU 2067 etc.	2.52*
2	Recommended Rice varieties for the North coastal zone are Srikakulam Sannalu (RGL 2537), Swarna (MTU 7029), Sona Mahsuri (BPT 3291), MTU 1010, Sri Druthi (MTU 1121)	2.4
3	Recommended Rice varieties for Southern Zone are NLR 3041, NLR 34449, MTU 1010, MTU 100, BPT 5204, NDLR 8, NDLR 7	2.56*
4	The correct sequence of seed progeny is breeder seed-foundation seed-certified seed-truthfully labeled seed	2.3
5	The colour of the tag used for breeder seed is a golden yellow tag	2.32
6	The colour of the tag used for the foundation seed is a white tag	2.32
7	The colour of the tag used for certified seed is azur blue	2.32
8	Recommended seed rate for transplanted rice is 20-25 kg $acre^{-1}$	2.64*
9	Recommended seed rate for direct sown rice is 10-15 kg $acre^{-1}$	2.54*

10	Recommended seed rate for SRI rice is 2 kg acre^{-1}	2.6*
11	Recommended seed rate for MSRI rice is 12-15 kg acre^{-1}	2.46
12	The age of seedlings for transplanting MSRI Rice is 14-17 days	2.6*
13	The number of trays required for transplanting MSRI rice is 70-80 acre^{-1}	2.52*
14	For wet seeding, seed priming should be done by soaking the seed for 24 hrs in water and then draining in gunny bags for another 24 hrs.	2.56*
15	The recommended sequence followed for seed treatment is fungicide-insecticide-culture (Rhizobium)	2.66*
16	Seed treatment reduces the control of seed borne diseases	2.66*
17	Seed treatment with Carbendazim @ 3g kg^{-1} in rice helps to control several fungal diseases	2.5*
18	Puddling in the rice field is essential to reduce excessive water percolation and loss of applied fertilizers due to leaching.	2.62*
19	The recommended nursery area required for growing one acre of the rice crop is 5 cents	2.48*
20	The recommended number of seedlings to be transplanted per hill is 2-3	2.54*
21	The optimum depth of planting rice seedlings is two 2-3 cm	2.44
22	Shallow planting of rice seedlings ensure profuse tillering	2.58*
23	Recommended spacing followed during kharif season is 20 X 30 cm	2.22
24	The optimum age of rice seedlings to be transplanted for getting good yields is 20-30 days	2.6*
25	The optimum number of rice hills per square meter to get higher yields during Kharif is 33 hills sq.mt^{-1}	2.64*
26	Alleyways of 20 cm size at every 2 meters apart in the main field facilitate free aeration and for uniform application of fertilizers, Weedicides and pest management practices.	2.66*
27	Nitrogen fertilizers can be reduced to the extent of 20-25 percent by using FYM, compost and poultry manure along with chemical fertilizers	2.56*
28	Inorganic fertilizers are more responsible for higher yields than organic fertilizers	2.28
29	Green manure crops increases nutrient efficiency in soil	2.72*
30	Sesbania, sunhemp, gliricidia, and cowpea, etc. are the green manure crops	2.54*
31	The ideal stage for incorporating green manure crops in the main field is 45 Days after sowing	2.6*
32	Growing up of legumes preceding to rice helps in improving the quality of produce and reduction in pest incidence	2.42
33	Azolla, Azospirillum, Blue green algae, and Azotobacter are the biofertilizers used in rice crop	2.64*
34	VAM mobilizes elements such as P, Zn, Cu and Mn	2.36
35	The recommended dose of Azospirillum for one acre is 2 kg culture mixed with 20 kg FYM	2.42
36	Nitrogen deficiency symptoms first occur on older leaves in the form of chlorosis and plant growth is stunted	2.36
37	The recommended dosage of Nitrogen fertilizer for kharif is 32-36 kg acre^{-1}	2.46
38	Nitrogen fertilizer should be used in 3 equal splits i.e., 1st dose during the last puddling, 2nd dose in tillering and 3rd at the panicle initiation stage	2.58*
39	Thin- film of water should be maintained at the time of N fertilizer application and water should be given 36-48 hours after nitrogen fertilizers application	2.4
40	One kg nitrogen is equivalent to 2.17 kg urea	2.3
41	The amount of N and P present in DAP is 18% and 46% respectively	2.3
42	Nitrogen use efficiency of 50 kgs urea can be improved by mixing with 10 kgs Neem cake	2.5*
43	Deficiency symptoms of Phosphorus are diagnosed as a dark green or purple green leaves	2.4
44	The recommended quantity of phosphorous fertilizer is 24 kg acre^{-1}.	2.5*
45	At the time of puddling, the entire recommended amount of P should be applied	2.66*
46	The recommended quantity of potash fertilizer is 16-20 kg acre^{-1}	2.52*
47	Potassium deficiency symptoms are characterized by reddish brown spots that appear along the veins of leaves and borders of leaves begin to turn yellow.	2.4
48	Half of the recommended amount of Potassium should be applied at the time of puddling and remaining at 60-65 DAS.	2.6*
49	Potash plays a key role in grain filling and increases grain weight in rice	2.56*
50	Potash is responsible for higher yields in rice	2.32
51	Soil testing is always better for the correction of soil micronutrients	2.64*
52	Zn deficient rice field shows brown, rusty and stunted plants in patches.	2.52*
53	The recommended dose of Zinc Sulphate for basal application is 20 kg acre^{-1}	2.56*
54	Foliar sprays with 2g ZnSO4 L-1, 2-3 times with 5 days interval is recommended for ameliorating Zn deficiency	2.64*
55	Iron deficiency symptoms include chlorosis of new leaves first between the veins and then the whole leaf.	2.54*
56	$FeSO_4$ 20-25 g L-1 + Citric Acid 2g L-1 spray is recommended to ameliorate iron deficiency.	2.48*
57	The recommended first and second hand weedings in rice crop are 20 DAT and 40 DAT, respectively	2.46
58	Pre-emergence herbicides are to be sprayed 24-48 hrs. after sowing.	2.54*
59	Post-emergence herbicides are to be applied at the 3-4 leaf stage of the weed	2.4
60	The recommended dose of Pendimethalin to be sprayed in direct sown rice to control grassy and broad leaved weeds is 1.5-2.0 litresacre^{-1}	2.34
61	The recommended dose of Oxadiargil (TOPSTAR) to control weeds in rice crop at 3-5 DAT is 35-50 g acre^{-1}	2.5*
62	The recommended dose of Cyahalofop P butyl (CLINCHER, WRAP UP) to control Echinochloa in nursey is 2ml	2.42
63	The recommended dose of Bispyribac Sodium (NOMINEE GOLD) for the control of both grassy and broad leaved weeds at 20 DAT is 100ml	2.56*
64	The recommended dose of 2,4 D Sodium salt to control broad leaved weeds at 25-30 DAS is 400g acre^{-1}	2.44
65	Proper water management facilitates good tillering, increased nutrient use and reduce weed infestation.	2.42
66	Maintain 5 cm of water during panicle initiation to physiological maturity (10 Days before harvest) of the crop.	2.42
67	Panicle initiation, Flowering and Milky stages in rice crop are moisture sensitive stages	2.6*
68	Drainage for a day or two during the beginning of the maximum tillering stage helps to stimulate the vigorous growth of roots and checks the development of non-effective tillers.	2.46

69	Plastering and trimming of bunds reduces the rat problem.	2.4
70	The recommended dose of poison bait to control rodents is 960 g cereal + 20 g oil + 20-25 g Zinc Phosphide or 20 g Bromodiolone @ 10 g per burrow.	2.56*
71	Bait shyness is the problem associated with acute poison chemicals like Zinc phosphide	2.28
72	Community based approach is the best method to control rodents	2.62*
73	Summer ploughing and destruction of crop residue helps to reduce pest and disease	2.58*
74	The two major pests in the rice crop are stem borer and BPH	2.48*
75	Dead hearts at the vegetative stage and White ears at the reproductive stage are symptoms of stem borer.	2.54*
76	Economic threshold level (ETL) means the population density at which control measures should be applied to prevent increasing pest population from reaching the economic injury level	2.32
77	The economic threshold level of rice stem borer is 1 egg mass m^{-2} or 1 moth m^{-2}	2.44
78	Clipping the tips of the seedlings prior to transplanting aids in the elimination of egg masses of stem borer	2.64*
79	The recommended number of Pheromone traps required to monitor yellow stem borer is 5 $acre^{-1}$	2.58*
80	Foliar sprays with Chlorpyriphos 20 EC @ 2.5 ml L^{-1} or Phosphamidon 40 SL 2.0 ml L^{-1} or Acephate 1.5 g L^{-1} or Cartap Hydrochloride 2 g L^{-1} can control stem borer.	2.48*
81	Spraying with Flubendamide (FAME) @ 50 g $acre^{-1}$ controls the infestation of the stem borer.	2.34
82	Premature yellowing of leaves and drying of plants in isolated circular patches are the symptoms of BPH	2.54*
83	Higher doses of nitrogen is the reason for BPH attack	2.46
84	The economic threshold level of BPH is 10 hoppers $hill^{-1}$ at tillering stage and 20-25 $hill^{-1}$ at heading stage.	2.44
85	Foliar spray with Buprofezin @ 1.6 ml^{-1} or Ethofenprox @ 2 ml l^{-1} controls BPH.	2.46
86	BPH is serious from panicle initiation to booting till post flowering	2.28
87	Formation of alleys or pathways of 20 cm width for every 2 m of planting reduces BPH attack	2.68*
88	Whitish membranous folded leaves with typical white streaks is characteristic symptom of leaf folder attack.	2.54*
89	Green leaf hoppers suck sap from leaves causing yellowing, stunting and withering of plants.	2.34
90	GLH spreads rice tungro virus, rice dwarf virus, rice yellow dwarf virus	2.36
91	The leaf folder is abundant during the rainy season with optimum temperature and high relative humidity.	2.44
92	Passing a rope 2-3 times over the crop at tillering stage dislodges the leaf folder caterpillars.	2.52*
93	ETL for leaf folder is 1 larva per hill and 2 damaged leaves/hill	2.42
94	The recommended chemicals used to control the leaf folder are Chlorpyriphos 20 EC @ 2.5 ml L^{-1} or Phlubendamide 20 WDG 0.25 g or 48SC 0.4 ml $litre^{-1}$ of water.	2.5*
95	Panicle mite causes brown necrotic patches that occurs on midribs at the vegetative phase and on leaf sheaths at the P.I stage.	2.48*
96	The recommended chemicals used to control panicle mite is Profenofos 50 EC @ 2 ml L^{-1} or Dicofol 5 EC @ 5 ml L^{-1}	2.48*
97	Symptoms of leaf blast are Spindle shaped spots on leaves	2.56*
98	The recommended chemicals used to control rice blast disease are Kasugamycin 3L @2.5 ml l^{-1} or Tricyclazole 75 WP (Beam) @ 0.6g l^{-1}.	2.48*
99	Sheath blight affects the crop from tillering to heading stage.	2.42
100	Oval or irregular greenish grey spots on leaf sheaths is the symptom of sheath blight.	2.44
101	Sheath blight can be controlled by spraying Hexaconazole (Contaf) 5 EC @ 2ml l^{-1} or Propiconazole (Tilt) 25 EC @ 1 ml l^{-1} or Validamycin (Sheathmar) 3L @ 2 ml l^{-1}	2.54*
102	Individual grains transform into yellow or greenish spore balls of velvety appearance when the plant is infected with false smut of rice.	2.56*
103	Rainfall and cloudy weather during the flowering and maturity periods are favorable for the spread of false smut.	2.62*
104	The recommended chemicals used for the control of false smut is Propiconazole 25EC @ 1 ml l^{-1} or COC 50 WP @ 2 g l^{-1} or Carbendazim 50WP @ 1 g l^{-1}	2.52*
105	Wilt syndrome known as Kresek is seen in seedlings within 3-4 weeks after transplanting is the symptom of bacterial leaf blight	2.54*
106	Application of nitrogen in split doses and growing resistant varieties helps to control BLB	2.48*
107	The components of Integrated pest management are cultural, mechanical, biological and chemical control methods.	2.5*
108	IPM helps in the maintenance of eco balance	2.48*
109	By conserving natural enemies in the field can be reduced the expenditure on the cost of pesticides	2.46
110	Crop rotation reduces the incidence of pest attack	2.46
111	Bio-control agents are the organisms (natural enemies) used to reduce the pest population	2.36
112	Spiders, ants, dragon flies and lady bird beetles are some important predators in Rice	2.34
113	Installing bird perches helps reduction of pest and conservation of bio control agents	2.36
114	Conserving natural enemies which are friendly helps to keep the pest population ecologically balanced	2.38
115	Trichocards (Bio control agents) should be released at three times in the field (60,000 eggs) to control the yellow stem borer and leaf folder.	2.52*
116	Each trichocard contains 20,000 parasitised eggs.	2.38
117	Harvesting the crop at the ground level reduces pest attack.	2.42
118	The combine harvester is the most useful and economically important labour saving machine	2.36
119	Rice grain with 10-14% moisture content can be stored in good condition around 180c for more than two years	2.36
120	Yield$acre^{-1}$ of the crop can be estimated by using the formula: No of $panicles m^{-2}$ X No of grains $panicle^{-1}$ X No of filled grains/100 X Test weight/1000 X 4000	2.06

From the above Table 1. It was observed that only 66 items had over all mean score value is ≥2.48.

2.3 Selection of items for item analysis

The selection of items was done on the basis of the following criteria

1. Response to items should promote thinking rather than rote memorization.
2. They should differentiate the well-informed rice farmers from the less informed and should have certain difficulty value.
3. The items included should cover all areas of knowledge about selected production technology of rice.

It means that the items which are not well understood by the rice farmers and items which can be correctly replied by all or none are not suitable for knowledge test. That is, the item should be able to discriminate the well informed rice farmers from the poorly informed ones.

2.4 Pre-testing

The items selected for the knowledge test were pretested separately by administering the 66 items to 60 rice farmers (selected at random). Care was taken to see that rice farmers selected for this purpose were outside the main sample i.e. non-sampled area.

2.5 Item analysis

The item analysis was carried out to yield three kinds of information *viz*., indices of 'Item Difficulty', 'Item Discrimination' and 'Point Biserial Correlation'. The index of item difficulty indicates the extent to which an item was difficult. The item discrimination index provides information on how well an item measures or discriminates a well-informed direct sown rice farmer from poorly informed ones. For item analysis, response obtained for multiple choice, fill in the blanks and 'true' or 'false' questions were arranged with a score of 'One' and 'Zero' for correct and incorrect responses, respectively. After computing the individual total score for 60 rice farmers, they were arranged in descending order based on total score. Then, they were divided into 6 equal groups arranged in descending order of total score obtained by them. These groups were named as G1, G2, G3, G4, G5 and G6 with 5 respondents in each group. For item analysis, the middle 2 groups G3 and G4 were eliminated keeping only 4 extreme groups, with high scores namely G1 and G2 and low scores namely G5 and G6. After getting the four extreme groups for item analysis, the responses for each of the items were subjected to calculate difficulty index, discrimination index and point biserial correlation as shown below.

2.6 Item difficulty index (P)

The item difficulty index was worked out as the percentage of the rice farmers answering an item correctly. The assumption of the item statistic of difficulty index was that, the difficulty is linearly related to the level of knowledge of rice farmers on selected production technology. It was computed by the following formula.

$$\text{Item difficulty index (P)} = \frac{\text{No of rice farmers answered correctly}}{\text{Total No of rice farmers}} \text{ X } 100$$

The items with 'P' values ranging from 20 to 80 (Pavankumar, 2019) [8] were considered for the final selection of the knowledge test to avoid the extremely simple and difficult items which distort the required homogeneity and discrimination. The values of the difficulty index for the knowledge items on selected production technology of direct sown rice are presented in Table 2.

2.7 Discrimination index ($E^{1/3}$)

The item discrimination index ($E^{1/3}$), which indicates the level of discrimination between well informed and poorly informed direct sown rice farmers, was computed using the formula given below.

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

Where, S1, S2, S5 and S6 are the frequencies of correct answers in the groups of G1, G2, G5 and G6, respectively. N is the total number of rice farmers selected for the item analysis i.e., 60. The items with $E^{1/3}$ values ranging from 0.20 to 0.80 were selected for the final test (See Table 2). The value of the discrimination index for the knowledge items on selected production technology of rice farmers are presented in Table 2.

2.8 Point biserial correlation (rpbis)

The main aim of calculating Point biserial correlation (rpbis) was to work out the internal consistency of the items i.e., the relationship of the total score to a dichotomized answer to any given item (Sureshverma *et al*., 2018) [14]. In a way, the validity power of the item was computed by the correlation of the individual item of the preliminary knowledge test was calculated. A large positive point-biserial value indicates that farmers with high scores on the overall test are also getting the item right and farmers with low scores on the overall test are getting the item wrong (Seemavarma, 2015) [11]. The results are presented in table 2. An item by item computation of point biserial correlation was calculated by using the following formula.

$$\text{rpbis} = \frac{\text{MP - MQ}}{\text{SD}} \text{ X } \sqrt{pq}$$

Where, rpbis = Point biserial correlation

MP = Mean of the total scores of the rice farmers who answered the items correctly

(or)

$$\text{MP} = \frac{\text{Sum of total of XY}}{\text{Total No of correct answers}}$$

MQ = Mean of the total scores of the rice farmers who answered the items incorrectly

(or)

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

S.D. = Standard deviation of entire sample (60 Nos.)

P = Proportion of rice farmers giving correct answer to the item

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

Q = Proportion of rice farmers giving incorrect answer to the item.
Q = 1 - P.
X = Total score of the rice farmer for all items.
Y = Response of the rice farmer for the specific items (Correct = 1, Incorrect =0).
XY = Total score of the respondent multiplied by the response of the individual to the item.
Items having significant point bi serial correlation at 1% and 5% level were selected for final knowledge test and are presented in Table 2.

Table 2: Difficulty and discrimination index for knowledge test items and point biserial correlations

S. No.	Frequencies of correct answer of respondents in four extreme groups				Totals of frequencies of correct answers by all six groups (N = 60)	Difficulty index P (% of respondents giving correct responses)	Discrimination index (E 1/3)	Point biserial correlation (rpbis)	't'
	G1	G2	G5	G6					
1	10	9	10	6	35	91.67	0.15	-0.6491	-6.49809NS
2	10	8	5	4	27	66.67	0.45	0.3413	2.765678*
3	8	9	7	6	30	76.67	0.2	0.3804	3.132285**
4	10	7	6	6	29	70	0.25	0.293 1	2.335343*
5	8	8	9	6	31	83.33	0.05	-0.7065	-7.60246NS
6	8	7	6	5	26	63.33	0.2	0.4476	3.812488*
7	2	4	5	4	15	43.33	-0.15	-0.5759	-5.36427NS
8	10	10	8	4	32	73.33	0.4	0.2847	2.261389*
9	10	5	4	7	26	58.33	0.2	0.3300	2.662372*
10	10	8	3	0	21	50	0.75	0.2615	2.06358*
11	5	6	3	1	15	31.67	0.35	0.3533	2.875818*
12	10	7	1	4	22	41.67	0.6	0.2856	2.26979*
13	9	5	6	6	26	63.33	0.1	-0.4919	-4.30328 NS
14	10	9	5	8	32	73.33	0.3	0.3133	2.512784*
15	10	9	8	3	30	80	0.4	0.3336	2.695172*
16	10	9	4	4	27	66.67	0.55	0.3499	2.844332*
17	8	8	9	7	32	76.67	0	-0.5253	-4.70204 NS
18	10	4	9	5	28	71.67	0	-0.1169	-0.89675 NS
19	10	5	7	4	26	63.33	0.2	0.2754	2.181441 *
20	10	9	10	9	38	93.33	0	-0.5592	-5.1369 NS
21	4	0	5	4	13	35	-0.25	-0.3717	-3.04969 NS
22	10	9	5	7	31	68.33	0.35	0.3079	2.464514 *
23	8	5	8	5	26	68.33	0	-0.6812	-7.08567 NS
24	8	9	5	4	26	63.33	0.4	0.2977	2.375319*
25	8	7	5	6	26	66.67	0.2	-0.4765	-4.12718 NS
26	7	7	6	1	21	50	0.35	0.3584	2.923688 **
27	9	8	6	6	29	65	0.25	0.3441	2.791403*
28	3	0	4	1	8	18.33	-0.1	-0.5974	-5.67387 NS
29	8	5	3	4	20	43.33	0.3	0.3627	2.963888*
30	10	5	4	6	25	46.67	0.25	0.4768	4.130497**
31	4	4	0	2	10	20	0.3	0.3386	2.740634*
32	10	10	8	3	31	80	0.45	0.2802	2.222655*
33	6	4	4	2	16	46.67	0.2	0.3920	3.245538*
34	7	10	8	7	32	75	0.1	-0.2340	-1.83323NS
35	10	7	7	7	31	76.67	0.15	0.0666	0.50848 NS
36	8	2	3	3	16	28.33	0.2	0.2572	2.026886 *
37	9	8	4	8	29	75	0.25	-0.5032	-4.43461NS
38	9	8	5	7	29	71.67	0.25	-0.3437	-2.7871 NS
39	5	9	6	4	24	56.67	0.2	0.3055	2.443598*
40	10	9	6	3	28	76.67	0.5	0.3195	2.568154*
41	7	2	2	2	13	28.33	0.25	0.3534	2.876667*
42	6	7	3	5	21	60	0.25	0.3099	2.482582**
43	10	7	4	6	27	70	0.35	0.3092	2.476258*
44	10	9	4	4	27	73.33	0.55	0.3008	2.401951*
45	1	2	1	3	7	11.67	-0.05	0.5850	5.493982**
46	8	4	0	5	17	43.33	0.35	0.3578	2.917723*
47	8	8	3	2	21	58.33	0.55	-0.1143	-0.87656 NS
48	8	7	5	4	24	48.33	0.3	0.2876	2.287206*
49	10	10	4	5	29	73.33	0.55	0.3086	2.470483*
50	6	1	6	3	16	35	-0.1	-0.1421	-1.09299 NS
51	10	7	6	7	30	76.67	0.2	0.3255	2.621404*
52	9	10	6	4	29	78.33	0.45	-0.2569	-2.02476 NS
53	6	9	8	4	27	71.67	0.15	-0.5292	-4.74982 NS
54	10	7	6	6	29	78.33	0.25	0.3445	2.795118*
55	10	3	8	7	28	76.67	-0.1	-0.6504	-6.52075 NS

56	8	8	6	6	28	75	0.2	0.3842	3.169056*
57	5	8	9	5	27	75	-0.05	-0.6448	-6.42503 NS
58	9	10	7	6	32	80	0.3	0.2895	2.303449 *
59	8	6	4	5	23	51.67	0.25	0.3317	2.677789*
60	7	10	5	6	28	78.33	0.3	-0.3547	-2.88941 NS
61	9	9	5	9	32	78.33	0.2	0.3156	2.532841 *
62	7	8	5	6	26	73.33	0.2	-0.2321	-1.8169 NS
63	8	10	7	7	32	78.33	0.2	-0.0313	-0.23819NS
64	5	10	8	6	29	73.33	0.05	-0.2711	-2.14517 NS
65	7	10	5	6	28	53.33	0.3	0.8053	10.34319 **
66	9	10	6	5	30	73.33	0.4	0.2599	2.049822 *

2.9 Representativeness of the test

Care was taken to see that the test items selected finally covered the entire universe of the relevant behavioral aspects of respondent's knowledge about their existing livelihood systems.

2.10 Selection of the items

Out of 66 items, 41 items were finally selected based on

1. Items with difficulty level indices ranging from 20 to 80
2. Items with discrimination indices ranging from 0.20 to 0.80
3. Items having significant point biserial correlation either at 1 percent or 5 percent level

Thus, the finally selected knowledge items comprising 3 types of questions i.e. Multiple Choice, Fill in the blanks and True or False, totaling to 41 items of test battery.

The final knowledge test items selected for the test are given in the interview schedule furnished in Table 3.

Table 3: Finalized items for knowledge test

Choose the correct answers from the following options

1.	The recommended fungicide for seed treatment		
	a) Carbendazim 3g/kg	b) Hexaconazole 2g/kg	c) Both
2.	The recommended sequence followed for seed treatment is		
	a) Fungicide-Insecticide-Biofertilizers (Azospirillum)		
	b) Insecticide- Biofertilizers (Azospirillum)Fungicide		
	c) Biofertilizers (Azospirillum)-Fungicide-Insecticide		
3.	Recommended seed rate for transplanted rice is		
	a)10-15 kg/acre	b) 40-45 kg/acre	c) 20-25 kg/acre
4.	Ideal stage for incorporating green manure crops in main field is		
	a) 70 DAS	b) 60 DAS	c) 70 DAS
5.	Optimum Number of paddy hills per square meter to get higher yields during Kharif is		
	a) 44 hills/sq.mt	b) 33 hills/sq.mt	c) 55 hills/sq.mt
6.	The optimum age of seedlings for transplanting MSRI Rice is		
	a) 20-25 Days	b) 14-17 Days	c) 30-35 Days
7.	Number of trays required for transplanting MSRI rice is		
	a) 70-80/acre	b) 90-100/acre	c) 100-110/acre
8.	Recommended seed rate for SRI rice is		
	a) 4 kg	b) 2 kg	c) 6 kg
9.	Which micro nutrient deficiency symptoms include chlorosis of new leaves first between the veins and then whole leaf		
	a) Zinc	b) Boran	c) Iron
10.	Rice field with symptoms brown, rusty and stunted plants in patches are the deficiency symptoms of which micro nutrient		
	a) Boran	b) Zinc	c) Iron
11.	How much quantity of $ZnSO_4$ should be applied as foliar spray?		
	a) 2 g/L	b) 10 g/L	c) 20 g/L
12.	Entire recommended dose of phosphorus should be applied at		
	a) Final Ploughing	b) Harvesting Stage	c) Booting Stage
13.	Critical water requirement stage in rice		
	a) Harvesting Stage	b) Tillering Stage	c) Panicle Initiation Stage
14.	Trichocards (Biocontrol agents) should be released at three times in the field (60,000 eggs) to control		
	a) Leaf folder	b) Yellow stem borer	c) Both
15.	Which pest dislodges when passing a rope 2-3 times over the rice crop at tillering stage		
	a) Panicle mite	b) Leaf folder	c) Stem borer

Fill in the blanks

16.	Recommended seed rate for one acre direct sown rice is _____
17.	The recommended quantity of potash fertilizer for one acre is _____
18.	The recommended quantity of phosporous fertilizer for one acre is _____
19.	The recommended dosage of oxadiargil (TOPSTAR) to control weeds in rice crop at 3-5 DAT is _____
20.	Individual grains transform into yellow or greenish spore balls of velvety appearance when the plant is infected are the symptoms of which pest _____
21.	Mention any two green manure crops _____

22.	Formation of alley ways help to control _____
23.	The recommended number pheromone traps required to monitor yellow stem borer is _____
24.	Dead hearts at vegetative stage and White ears at reproductive stage are symptoms of which pest _____
25.	Mention any two major pests in Rice _____
26.	Spindle shaped spots on leaves are the symptoms of which pest _____
27.	Recommended chemicals for the control of leaf folder are _____
28.	Premature yellowing of leaves and drying of plants in isolated circular patches are the symptoms of which pest _____
29.	The recommended chemicals used for the control of sheath blight is _____
30.	Water soaked, translucent lesions near leaf margins, wavy margins, straw yellow leaves are the symptoms of which disease _____
31.	Mention any two biofertilizers used in Rice crop _____

True or False

32.	Shallow planting of Rice seedlings cannot ensure profuse tillering True/False
33.	Seed treatment cannot reduce the control of seed borne diseases True /False
34.	Recommended Rice varieties for Godavari zone are MTU 1010, MTU 1001, BPT 5204, MTU 7029, MTU 2067 etc. True/False
35.	Nitrogen fertilizers can be reduced to the extent of 20-25 percent by using FYM, compost and poultry manure along with chemical fertilizers True/False
36.	Application of nitrogen in split doses and growing resistant varieties helps to control BLB True/False
37.	Half of the recommended amount of Potassium should be applied at the time of puddling and remaining at 60-65 DAS True/False
38.	The recommended dose of poison bait to control rodents is 960 g cereal + 20 g oil + 20-25 g Zinc Phosphide or 20 g Bromodiolone @ 10 g per burrow True/False
39.	Rainfall and cloudy weather during the flowering and maturity periods are favorable for spread of false smut True/False
40.	The components of integrated pest management are mechanical, biological and chemical control methods only True/False
41.	Green manure crops cannot increases nutrient efficiency in soil True/False

2.11 Reliability of knowledge test

According to Kerlinger (1973) [6] "Reliability is the accuracy or precision of measuring instrument". Reliability of the scale was determined by split-half method. The selected items i.e., Fourty-one (41) items were divided into two halves. The two halves were further administered separately to 30 farmers in a non-sample area (Krishna district of Andhra Pradesh). The scores were subjected to product moment correlation test in order to find out the reliability of the scale.

The half-test reliability co-efficient (r) was 0.72. Further, the reliability co-efficient of the whole test was computed using the Spearman Brown Prophecy Formula (Singh, 2017) [12] given below.

$$\text{Reliability co-efficient of whole test} = \frac{2 \text{ x Reliability co-efficient of half test}}{1 + \text{Reliability co-efficient of half test}}$$

The whole test reliability co-efficient of the whole test was computed using the Spearman Brown Prophecy worked out and the results were 0.83 for the items selected for rice crop. The calculated value of reliability Co-efficient (0.83) for whole test found to be highly significant, hence it was concluded that the test was reliable.

2.12 Validity of the test

Knowledge test developed on production technologies in general and protection technologies in particular were subjected to content and construct validity (Sarkar *et al*., 2014) [10]. The construct validity of the test items was tested by the method of point biserial correlation (rpbis). The items have significant values at 1 percent and 5 percent level indicated the validity of the test. The content validity of knowledge test was derived from a large pool of test items separately. The test items represented the whole universe of production and protection technologies of rice crop. It was thus assumed that the scores obtained by administering the knowledge test of this study measures what intended to measure. Thus the knowledge test developed in the present study can measure the knowledge of the rice farmers towards production technologies and showed a greater degree of reliability and validity indicating that the test items were valid.

3. Results and discussion

Out of 66 items, 41 items were finally selected based on item difficulty index, discrimination index and t values. Each of the 41 items in the knowledge test were administered to the respondents in Telugu language and their responses were recorded in the form of correct or incorrect answers. The correct answer was assigned a weightage of "1" and a weightage of "0" was assigned to incorrect answer.

4. Conclusion

The standard test conducted to measure the knowledge of rice farmers on recommended practices is useful for the researcher to find out number of items actually related to measure the knowledge level of the rice farmers.

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