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# Standard test to measure knowledge of dry direct seeded rice farmers in Srikakulam district of Andhra Pradesh

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## ABSTRACT

Dry Direct Seeded Rice (DDSR) has gained recognition as a resource-saving substitute for the traditional method of transplanting seedlings into puddled fields. However, whether this practice spreads widely among farmers depends heavily on how completely they grasp the recommended cultivation guidelines. The current study was conducted in Srikakulam district of Andhra Pradesh to develop and validate a reliable tool for measuring growers' understanding of scientific DDSR production methods. With guidance from researchers, technical experts, master trainers and grassroots extension workers, a preliminary collection of fifty statements was compiled and then reviewed for suitability and lucidity. This refined set was administered to thirty farmers outside the main sample, after which each statement underwent item analysis employing the difficulty index, discrimination index and point biserial correlation. Statements showing difficulty between thirty and seventy per cent, discrimination ranging from 0.30 to 0.70, and point biserial values significant at one or five per cent were kept. Ultimately, thirty qualifying statements were chosen and presented through three answer formats. A split-half reliability figure of 0.86 verified the instrument's consistency, whereas the point biserial method confirmed its validity. This finalized test gives extension organisations a trustworthy way to assess knowledge and identify gaps requiring targeted training.

**Key Words**: *Dry direct seeded rice, Difficulty index, Discrimination index, Item analysis, Knowledge test and Point biserial correlation*

Rice (*Oryza sativa* L.) is the principal staple food of India and the backbone of livelihood security for millions of rural households. Sustaining its production is therefore central to the nation's food security. The conventional method of raising rice through puddling and transplanting in standing water is however highly demanding of water, labour and energy and the steady depletion of irrigation water together with the rising scarcity and cost of farm labour has compelled scientists and farmers alike to look for less resource intensive establishment methods.

Dry direct seeded rice in which dry seed is drilled or broadcast directly into an unpuddled, dry-tilled or zero-tilled field has gained considerable attention as one such alternative. The technology dispenses with the nursery, puddling and transplanting operations, thereby saving a substantial quantity of irrigation water, reducing labour requirement and cultivation cost, advancing the date of sowing and lowering methane emission (Kumar and Ladha, 2011). At the same time it brings its own management challenges, the most important being aggressive weed competition (Chauhan, 2012) and altered nutrient availability, which make a sound knowledge of the recommended practices indispensable for realising the potential of the system.

Knowledge is widely regarded as the first and the most decisive step in the adoption process (Bloom *et al.,* 1956) for a farmer can scarcely be expected to practise correctly what he does not adequately understand. An objective appraisal of the level of knowledge possessed by cultivators consequently becomes essential both for diagnosing the gaps that hinder adoption and for designing focused extension interventions (Rohila *et al.,* 2017). Such an appraisal calls for a measuring instrument that is reliable, valid and standardised against accepted psychometric norms.

In spite of the growing promotion of dry direct seeded rice in the coastal districts of Andhra Pradesh,

no standardised instrument was available for measuring the knowledge of growers about its production technology. The present study was according undertaken in Srikakulam district with the specific objective of constructing and standardising a knowledge test capable of measuring the knowledge level of dry direct seeded rice farmers regarding scientific production recommendations. This developed knowledge test is intended to serve as a reliable tool for extension personnel and researchers to evaluate gaps in farmers adoption.

## MATERIAL AND METHODS

The study was conducted in Srikakulam district of Andhra Pradesh where dry direct seeded rice is being promoted as a water and labour saving establishment technique. A standardised knowledge test was developed by following the sequence of construction and standardisation described below, so as to obtain an instrument that would faithfully reflect the level of knowledge of the growers about the selected production technology.

### a) Collection and framing of knowledge items

A large pool of items relating to the recommended production technology of dry direct seeded rice was generated in consultation with the scientists associated with the Vyavasaya Panchangam of Acharya N.G. Ranga Agricultural University, subject matter specialists, master trainers and field extension workers of the University and of the State Department of Agriculture. After careful editing for relevance, clarity and freedom from ambiguity, fifty items were retained for further standardisation.

### b) Criteria for selection of items

The items were framed as questions and were chosen so that the response to each item would stimulate thinking rather than mere rote memorisation, so that each item would distinguish the well informed grower from the poorly informed one and carry a reasonable difficulty value and so that the set as a whole would cover every important facet of dry direct seeded rice cultivation.

### c) Item analysis

The fifty edited items were pre-tested on thirty respondents who were deliberately kept outside the main sample of the study. Each respondent was scored by allotting one mark for a correct answer and zero for an incorrect answer and the total scores were arranged in descending order. The thirty respondents were then divided into six equal groups of five each, designated G1 to G6 from the highest to the lowest scorers. The two middle groups, G3 and G4 were dropped and only the four extreme groups were retained for analysis. For each of the fifty items the frequency of correct responses in these four groups was tabulated and three statistics, namely the difficulty index, the discrimination index and the point biserial correlation were computed (Garrett, 1966).

The difficulty index expresses the proportion of growers answering an item correctly, the assumption being that difficulty is linearly related to the level of knowledge. Items with difficulty values ranging from 30 to 70 per cent will be considered suitable for the final test. It was worked out as follows

$$\textbf{Item difficulty index} = \frac{\textbf{Number of farmers answered correctly}}{\textbf{Total number of farmers}} \times 100$$

The discrimination index ($E^{1/3}$) indicates the extent to which an item distinguishes the well informed from the poorly informed growers (Guilford, 1954) and was computed as follows

$$\textbf{Discrimination index } (E^{1/3}) = \frac{(S_1 - S_2) - (S_5 - S_6)}{N/3}$$

S1, S2, S5 and S6 are the frequencies of correct answers in groups G1, G2, G5 and G6 and N is the total number of respondents taken for item analysis. Items with a discrimination index between 0.30 and 0.70 will be selected.

The point biserial correlation was used to judge the internal consistency of each item, that is, the relationship between the total score and the dichotomised response to the item and was obtained as :

$$\textbf{rpbis} = \frac{\textbf{Mp} - \textbf{Mq}}{\textbf{SD}} x\sqrt{\textbf{pq}}$$

Mp and Mq are the mean total scores of respondents answering the item correctly and incorrectly, SD is the standard deviation of the whole sample and p and q are the proportions of correct and incorrect responses.

The significance of the coefficient was tested with :

$$t = \frac{rpbis\sqrt{N-2}}{\sqrt{1-rpbis^2}}$$

rpbis is the point biserial correlation and N is the total number of respondents of the sample selected for the item analysis.Items whose point biserial correlation was significant at the one or five per cent level will be retained for the final test.

**d) Reliability and validity**

The reliability of the test was established by the split-half method (Cronbach, 1951) in which the test was administered to thirty respondents .The validity was examined through the point biserial correlation and the items showing significant coefficients at the one or five per cent level were treated as valid for inclusion in the standard test.

**e) Items finally selected**

Out of the fifty items thirty items pertaining to the production recommendations of dry direct seeded rice satisfied all three psychometric criteria simultaneously and were finally selected. These items were distributed across three response formats, namely true or false, multiple choice and fill in the blank questions.

**Table 1. Difficulty index, discrimination index, point biserial correlation and 't' values of the fifty knowledge-test items at the item-analysis stage**

| S. No. | G1 | G2 | G5 | G6 | Total correct (n = 30) | Difficulty index (%) | Discrimination index (E1/3) | Point biserial (rpbis) | 't' value |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 5 | 3 | 1 | 20 | 66.67 | 0.4 | 0.45 | 2.66 * |
| 2 | 1 | 0 | 0 | 0 | 1 | 3.33 | 0.1 | 0.099 | 0.53 NS |
| 3 | 4 | 5 | 2 | 2 | 19 | 63.33 | 0.5 | 0.366 | 2.08 * |
| 4 | 5 | 3 | 2 | 1 | 17 | 56.67 | 0.7 | 0.334 | 2.27 * |
| 5 | 5 | 4 | 1 | 0 | 16 | 53.33 | 0.8 | 0.609 | 4.07 ** |
| 6 | 5 | 3 | 3 | 1 | 19 | 63.33 | 0.4 | 0.439 | 2.59 * |
| 7 | 5 | 4 | 1 | 0 | 15 | 50 | 0.8 | 0.579 | 3.38 ** |
| 8 | 5 | 5 | 2 | 0 | 16 | 53.33 | 0.8 | 0.538 | 3.38 ** |
| 9 | 4 | 3 | 1 | 0 | 11 | 36.67 | 0.6 | 0.255 | 1.39 NS |
| 10 | 4 | 4 | 3 | 2 | 21 | 70 | 0.3 | 0.381 | 2.18 * |
| 11 | 4 | 4 | 1 | 0 | 16 | 53.33 | 0.7 | 0.51 | 3.14 ** |
| 12 | 4 | 4 | 0 | 0 | 16 | 53.33 | 0.8 | 0.564 | 3.61 ** |
| 13 | 5 | 3 | 2 | 1 | 14 | 43.33 | 0.6 | 0.351 | 2.08 * |
| 14 | 5 | 4 | 2 | 2 | 22 | 66.67 | 0.5 | 0.608 | 4.06 ** |
| 15 | 3 | 2 | 2 | 0 | 11 | 36.37 | 0.3 | 0.159 | 0.85 NS |
| 16 | 3 | 3 | 1 | 2 | 14 | 46.67 | 0.3 | 0.121 | 0.64 NS |
| 17 | 4 | 4 | 2 | 0 | 18 | 60 | 0.6 | 0.564 | 3.32 ** |
| 18 | 4 | 1 | 4 | 0 | 16 | 53.33 | 0.1 | 0.209 | 1.13 NS |
| 19 | 4 | 3 | 4 | 2 | 17 | 56.66 | 0.7 | 0.369 | 2.10 * |
| 20 | 5 | 4 | 0 | 0 | 9 | 56.67 | 0.9 | 0.427 | 2.50 * |
| 21 | 5 | 3 | 2 | 0 | 14 | 46.67 | 0.6 | 0.439 | 2.59 * |
| 22 | 4 | 3 | 0 | 4 | 18 | 60 | 0.3 | 0.037 | 0.19 NS |
| 23 | 4 | 4 | 1 | 0 | 10 | 33.33 | 0.7 | 0.413 | 2.40 * |
| 24 | 4 | 3 | 2 | 3 | 17 | 56.67 | 0.2 | 0.129 | 0.69 NS |
| 25 | 5 | 2 | 2 | 0 | 15 | 50 | 0.5 | 0.417 | 2.43 * |
| 26 | 3 | 2 | 2 | 2 | 15 | 50 | 0.1 | 0.122 | 0.63 NS |
| 27 | 4 | 3 | 2 | 1 | 22 | 73.33 | 0.5 | 0.335 | 2.12 * |
| 28 | 5 | 4 | 3 | 1 | 20 | 66.67 | 0.5 | 0.623 | 4.21 ** |
| 29 | 5 | 3 | 0 | 0 | 16 | 53.33 | 0.8 | 0.697 | 5.15 ** |
| 30 | 5 | 4 | 2 | 1 | 18 | 60 | 0.6 | 0.578 | 3.74 ** |

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| S. No. | G1 | G2 | G5 | G6 | Total correct (n = 30) | Difficulty index (%) | Discrimination index (E1/3) | Point biserial (rpbis) | 't' value |
|---|---|---|---|---|---|---|---|---|---|
| 31 | 5 | 5 | 3 | 2 | 21 | 70 | 0.5 | 0.608 | 4.06 ** |
| 32 | 5 | 4 | 3 | 5 | 24 | 80 | 0.1 | 0.029 | 0.16 NS |
| 33 | 5 | 2 | 0 | 0 | 14 | 46.67 | 0.7 | 0.442 | 2.61 * |
| 34 | 4 | 5 | 2 | 2 | 20 | 66.67 | 0.5 | 0.437 | 2.57 * |
| 35 | 5 | 4 | 2 | 2 | 21 | 70 | 0.5 | 0.513 | 3.17 ** |
| 36 | 4 | 3 | 2 | 1 | 19 | 66.67 | 0 | 0.038 | 0.20 NS |
| 37 | 3 | 3 | 4 | 2 | 16 | 53.33 | 0 | 0.048 | 0.21 NS |
| 38 | 4 | 3 | 2 | 1 | 20 | 66.67 | 0.4 | 0.549 | 3.47 ** |
| 39 | 5 | 2 | 4 | 3 | 22 | 73 | 0 | 0.064 | 0.34 NS |
| 40 | 5 | 4 | 3 | 3 | 20 | 66.67 | 0.3 | 0.21 | 1.14 NS |
| 41 | 4 | 3 | 2 | 1 | 18 | 60 | 0.4 | 0.445 | 2.64 * |
| 42 | 2 | 3 | 2 | 2 | 17 | 56.67 | 0.1 | 0.052 | 0.27 NS |
| 43 | 5 | 4 | 4 | 2 | 21 | 60 | 0 | 0.083 | 0.54 NS |
| 44 | 2 | 4 | 4 | 2 | 18 | 60 | 0 | 0.083 | 0.44 NS |
| 45 | 3 | 3 | 3 | 1 | 15 | 50 | 0.2 | 0.134 | 0.61 NS |
| 46 | 4 | 4 | 3 | 2 | 20 | 66.67 | 0.3 | 0.397 | 2.07 * |
| 47 | 2 | 4 | 3 | 2 | 15 | 50 | 0.1 | 0.083 | 0.44 NS |
| 48 | 5 | 4 | 3 | 1 | 20 | 66.67 | 0.5 | 0.656 | 4.60 ** |
| 49 | 5 | 4 | 2 | 1 | 18 | 60 | 0.5 | 0.354 | 2.14 * |
| 50 | 4 | 3 | 3 | 0 | 15 | 50 | 0.4 | 0.271 | 1.49 NS |

** Significant at 0.05 level of probability ** Significant at 0.01 level of probability NS Non-significant*

## RESULTS AND DISCUSSION

The values of the difficulty index, discrimination index, point biserial correlation and the corresponding 't' statistic computed for all the fifty items during the item-analysis stage are presented in Table 1. The data show a wide spread in the behaviour of the items ranging from those answered correctly by almost every respondent to those answered correctly by very few which is precisely the variation needed to identify items of acceptable discriminating power.

A scrutiny of Table 1 reveals that a large number of the items recorded difficulty values lying within the desirable band of 30 to 70 per cent indicating that they were neither so easy that almost everyone answered them correctly nor so hard that almost no one did. Items that fell outside this band such as item 2 with a difficulty value of only 3.33 per cent and item 32 with a value as high as 80.00 per cent were considered unsuitable because extreme items contribute little to the discriminating ability of the test.

Likewise the discrimination indices of the retained items lay between 0.30 and 0.70 confirming their capacity to separate the well informed from the poorly informed respondents whereas items with very low or zero discrimination, for example items 36, 37, 43 and 44 were rejected. The point biserial correlation of the selected items was positive and significant either at the one or the five per cent level, establishing that each retained item measured the same underlying knowledge as the test as a whole. Only those items meeting all three requirements at the same time were carried forward to the final instrument.

The thirty items that emerged from this triple screening are presented in Table 2. The selected items span the entire range of recommended dry direct seeded rice practices covering the comparative advantages of the system, choice of varieties and seed rate, land preparation and sowing, nutrient management, weed management, water management and the management of major insect pests and diseases. This balanced coverage ensures that the test

**Table 2. Knowledge statements of the thirty items finally selected for the standard test**

| Item No. | Knowledge statement |
|---|---|
| 1 | DSR saves irrigation water and labour cost compared with transplanted rice. |
| 2 | Recommended seed rate for DSR is 15-20 kg per acre. |
| 3 | Varieties with thicker stems, better rooting and a non-lodging nature are suitable. |
| 4 | Final ploughing should be done with a rotavator for better germination. |
| 5 | Sowing with a ferti-cum-seed drill is better than broadcasting. |
| 6 | Nitrogen is applied in two splits for short and medium duration varieties. |
| 7 | Recommended fertiliser per acre is N 32 kg, P 24 kg and K 20 kg. |
| 8 | Phosphatic fertiliser is applied at final field preparation before sowing. |
| 9 | Half of the recommended potassium is applied at final ploughing and the rest at the PI stage. |
| 10 | Potassium deficiency shows reddish-brown spots along the veins and yellowing. |
| 11 | Pre-emergence herbicides are sprayed within 24 hours of sowing. |
| 12 | Post-emergence herbicides are applied at the 3-4 leaf stage (15-20 DAS). |
| 13 | Pre-emergence pendimethalin @ 1.5-2.0 L per acre or pretilachlor is applied at 3-5 DAS. |
| 14 | Grassy weeds are controlled at 25 DAS with fenoxaprop-p-ethyl @ 200-260 ml per acre. |
| 15 | A foliar spray of bispyribac sodium @ 100 ml per acre at 20 DAS controls weeds. |
| 16 | Sufficient soil moisture is needed during post-emergence herbicide application. |
| 17 | Up to the boot-leaf stage the soil should be kept moist without standing water. |
| 18 | 'Dead hearts' and 'white ears' are symptoms of stem borer. |
| 19 | Cartap hydrochloride 4G @ 8 kg per ha at panicle initiation controls stem borer. |
| 20 | High nitrogen doses and high plant density invite brown plant hoppers. |
| 21 | Alleys of 20 cm width every 2 m improve aeration and reduce BPH. |
| 22 | The ETL of BPH is 10 hoppers per hill at tillering and 20-25 per hill at heading. |
| 23 | A foliar spray of buprofezin @ 300 ml per acre controls BPH. |
| 24 | Dinotefuran @ 100 g or pymetrozine @ 120 g per acre controls BPH. |
| 25 | Cartap hydrochloride 50 SP or profenophos 50 EC controls leaf folder. |
| 26 | Spindle-shaped brown spots on the leaves are due to leaf blast. |
| 27 | Dry seed treatment with 3 g carbendazim per kg seed prevents rice blast. |
| 28 | Tricyclazole (BEAM) @ 120 g per acre controls blast disease. |
| 29 | Sheath blight is controlled by hexaconazole, propiconazole or validamycin. |
| 30 | Propiconazole 25 EC or COC 50 WP at 50% flowering controls false smut. |

** Significant at 0.05 level of probability ** Significant at 0.01 level of probability*

measures knowledge of the whole production technology rather than of any single component.

The high split-half reliability coefficient of 0.86 obtained for the test demonstrates that the instrument yields consistent results on repeated use while the significant point biserial correlations of all the retained items confirm its validity. A test possessing both these properties can be relied upon to measure the true knowledge level of the respondents and to reveal the specific practices about which they are least informed. The pattern of results is in close agreement with earlier knowledge-test studies in agricultural extension which adopted the same difficulty, discrimination and point biserial criteria for retaining items (Chaitanya and Kumar, 2020).

The standardised test developed in this study therefore provides extension personnel and research workers with a ready and dependable tool for assessing how much dry direct seeded rice growers know about the recommended technology. By locating the weak areas of knowledge, it can guide the formulation of focused, need based training programmes and thereby contribute to a wider and more correct adoption of the technology in the district.

## CONCLUSION

A standardised knowledge test consisting of 30 carefully screened items was successfully constructed to measure the knowledge of dry direct seeded rice farmers of Srikakulam district about

scientific production technology. The items were retained only after satisfying the accepted norms of difficulty (30 to 70 per cent), discrimination (0.30 to 0.70) and significant point biserial correlation and the instrument exhibited a high split-half reliability of 0.86 together with established validity. Covering the full range of recommended practices from crop establishment through nutrient, weed, water, pest and disease management, the test is a reliable and valid instrument that extension agencies can use to assess knowledge levels, diagnose knowledge gaps and design appropriate training interventions to accelerate the adoption of dry direct seeded rice.

## LITERATURE CITED

**Bloom B S, Engelhart M D, Furst E J, Hill W H and Krathwohl D R 1956.** Taxonomy of educational objectives: The classification of educational goals. Longmans, Green and Company, New York. pp. 201-207.

**Chaitanya V and Kumar K R 2020.** Knowledge and adoption levels of the farmers on direct seeding among rice farmers of Khammam district of Telangana State, India. *International Journal of Current Microbiology and Applied Sciences*. 9 (6): 1877-1887.

**Chauhan B S 2012.** Weed ecology and weed management strategies for dry-seeded rice in Asia. *Weed Technology*. 26 (1): 1-13.

**Cronbach L J 1951.** Coefficient alpha and the internal structure of tests. *Psychometrika*. 16 (3): 297-334.

**Garrett H E 1966.** Statistics in Psychology and Education. Vakils, Feffer and Simons Private Limited, Bombay. pp. 359-370.

**Guilford J P 1954.** Psychometric methods (2nd ed.). McGraw-Hill Book Company, New York. pp. 417-434.

**Kumar V and Ladha J K 2011.** Direct seeding of rice: Recent developments and future research needs. *Advances in Agronomy*. 111 (1): 297-413.

**Rohila A K, Yadav K and Kumar A 2017.** Knowledge and adoption level of farmers about scientific rice cultivation practices. *Journal of Community Mobilization and Sustainable Development*. 12 (1): 24-28.

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