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Standardization of farm mechanization practices for the benefit of farmers

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■ **ABSTRACT :** In post-independence era, Indian farming has been transformed from subsistence farming to modern agriculture. The sources of energy on farm power, agricultural practices and farm technologies and crops have been under gone a sea change. This is the evident from the data on number of mechanical power units used in farming. Number of tractors, electric motors, diesel engines, power tillers and self-propelled combine harvesters has increased by manifolds during the second half the twentieth century. The progress of farm mechanization has been closely linked with the overall improvement in agriculture production and productivity. The results has been shown in standardization of farm mechanization in ragi and maize crop the relevancy weightage considered was more than 0.70 values, Relevancy percentage was consider was more than 70% of values, Mean relevancy score was more than 2.0 values. Reliability values found in ragi and maize crop is follows, split-half method ($r_{1/2}$) 0.9132, 0.9138 and whole test method (RII) 0.9546, 0.9550 and validity values found 0.9770, 0.9772, respectively. The research study is prominent agricultural engineering extension technology to develop dry land agriculture and enhance the productivity and production of dry land farmers in Karnataka. It is the research which will be more helpful to farmers to promote old farm mechanization practices to advanced farm mechanization practices in agriculture.

■ **KEY WORDS :** Bengaluru rural, Maize, Mechanization, Ragi, Standardization, Reliability, Validity

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Rainfed farming is the backbone of Indian agriculture, with major chunk towards agricultural production. Mechanization in agriculture by way of use different farm power sources, advanced farm tools, equipments, with a view in farm mechanization to reduce drudgery of human beings and draughts animals, thereby increasing crop production and productivity. Development of agriculture mechanization in Karnataka is an approach to shift from subsistence farming to commercial production. To improve farm mechanization in Karnataka, it is necessary to find out the challenges and solutions to them in agriculture sector. Further, agricultural mechanization is an approach which makes possible the development of the agriculture sector. Therefore, farm mechanization development planning is the main factor in agricultural development planning. However, mechanization in agriculture is the process of using agricultural machinery to carry out work in agriculture which is most of times human drudgery oriented, to greatly increase farm worker productivity

as well to ensure timely operations. Hence, the present study is taken up with the following objective: To standardize the farm mechanization practices for the benefit of farmers in Bengaluru Rural district, Karnataka.

METHODOLOGY

The study was conducted farm facilitators available at RSK's in Bengaluru Rural district during 2015-16. Methods used to identify and standardize agriculture farm mechanization techniques would increase farm productivity and incomes, and also contributing farm mechanization extension for agriculture development. Several research and evaluation studies conducted in the country reported that there was no concerted attempt to standardize farm mechanization extension techniques for agriculture development. Even though more emphasis has been given to farm mechanization extension by several organizations in the country but any study has not been reported regarding the standardization of available statistical techniques. Hence, the study is first of its kind in the country. However, the Government and as well as Non-Governmental organization started promoting farm mechanization extension techniques in agriculture among farmers. Thus, it is necessary to develop and standardize statistical techniques which could provide more objective of agriculture development in the country. Keeping this in view an attempt has been made to standardize statistical techniques. The steps indicated below were followed in the process of standardization.

Item collection :

Extensive literature on the subject will be collected, synthesized and a draft technical material was prepared in consultation with the subject experts. Final technical material prepared and the material was given to the senior experts to scrutinize and was modified as per the suggestions given by them. The modified material was given to 30 judges to judge the subject matter coverage, logical arrangement of the information considering the entire subject, understandability of the subject, relevancy of the subject etc., based on the judges ratings and recommendation the material was further revised and condensed. The revised material will be pretested based on the response modification was done to make it more understandable. In the prophase the instructions regarding usage of the material was given for the benefit of reader. The items were given to 30 judges again to judge for its relevancy on 3 point continuum and the relevancy percentage will be ranked.

Selection of Judges :

A list of judges will be prepared, out of this list a total number of 30 judges who were experts or knowledgeable persons in the area of agricultural engineering were randomly selected. The judges belong to the following categories (a)Authors who have written books or published research papers or attended seminars, conferences, symposium, workshops etc., on agricultural engineering development in Karnataka (b) Knowledgeable persons working in the field of agricultural engineering national and international concerned governmental organizations (c) Project personal and field workers at the micro level who have responsibility to promote agricultural engineering programmes of micro or maso level or macro level farm mechanization techniques (d) Voluntary organizations or agencies or NGO's who have implemented agricultural engineering programmes under agricultural development.

Obtaining opinion of the judges :

The judges were requested to give their opinion regarding suitability of the broad items for standardization. They were also requested to use 3 point rating which consisted of most relevant, relevant and not relevant.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Collection of items :

The objective of collection of implements for the attitude scale construction is to select the items in such a way that acceptance and rejection of each one will imply favorable or unfavorable attitude towards the farm mechanization. The items have been carefully edited and selected in accordance with set criteria as the items in any psychological test. The first step in the standardization of items was to collect exhaustive statements or items pertaining to the farm mechanization each expressing some opinion about the psychological object under the study. A large number of items were collected from literature, informal discussions with agriculture extension

and the other experts from selected areas and informal interviews with the members of farm mechanization. Tentative list of 43 implements from ragi and maize crop pertaining to the implements towards the farm mechanization was prepared.

Editing of the items :

The statements were edited as consequence 7 implements from ragi and 12 implements from maize crop were eliminated and the remaining 36 implements from ragi and 31 implements from maize crop in farm mechanization were included for the study.

Relevancy analysis :

The selected items were then subjected to scrutiny by an expert panel of judges to determine their relevancy and subsequent screening of the items for their inclusion in the final scale. In this context, 43 implements from ragi crop were mailed to 40 experts in the agricultural engineering and other related fields working in State Agricultural Universities (SAUs), Agricultural Engineering Extension experts, Central Agriculture University (CAU), Central Institute For Dry land Agriculture (CRIDA), ICAR institutions and Karnataka State Department of Agriculture (KSDA) and the social scientists with considerable practical experience. They were requested to critically evaluate the relevancy of each statement *viz.*, most relevant (MR), relevant (R), and not relevant (NR) with the score of 2, 1, 0, respectively. The judges were also requested to make necessary modifications and additions or deletion of implements, if they desire so. A total of 30 (75 %) judges returned the questionnaires duly completed were considered for further processing of research study. From the data gathered, relevancy percentage and mean relevancy score were worked out for all the 43 implements from each crop. All the necessary data related to ragi crop have been pertained in Table 1 and maize crop related data have been pertained at Table 2.

$$\text{Relevancy weightage} = \frac{MR*3 + R*2 + NR*1}{\text{No. of judges responded x Max. possible score}}$$

where,
MR= Most relevant
R= Relevant
NR=Not relevant

$$\text{Relevancy percentage} = \frac{MR*3 + R*2 + NR*1}{\text{No. of judges responded x Max. possible score}} * 100$$

where,
MR= Most relevant
R= Relevant
NR=Not relevant

$$\text{Mean relevancy score} = \frac{MR*3 + R*2 + NR*1}{\text{No. of judges responded}}$$

where,
MR= Most relevant
R= Relevant
NR=Not relevant

Using these criteria the implements were screened in ragi crop having relevancy percentage of more than 70% and mean relevancy score of more than 2.0 for further processing. A total of 36 implements from ragi and 31 implements from maize were retained after relevancy test and suitably modified as per the comments of experts wherever applicable.

Item analysis :

To delineate the items based on the extent to which they can differentiate about farm mechanization as favorable or unfavorable. Item analysis was carried out on the items selected in the first stage. 36 implements from ragi and 31 implements from maize were subjected for 't' test to know the difference in highest and lowest responses for the relevancy. The responses of the judges with respect to the different implements were subjected for difference in highest and lowest responses for the relevancy was done. Based upon the total scores, the judges were arranged in descending order. The top 25 per cent of the respondents with their total scores were considered as high group and the bottom 25% as the low group so that these two groups provided the criterion groups in terms of evaluating the individual implements. The 't' values were worked out in order to discrimination the responses of high and low groups for the individual implements by using the below mentioned formula.

$$t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\frac{\Sigma X^2_H - \frac{(pX_H)^2}{n} \times pX^2_L - \frac{(pX_L)^2}{n}}{n(n-1)}}}$$

where,
X_H= The mean score on given statement of the high

Table 1 : Relevancy weightage, relevancy percentage, mean relevancy score and 't' values for standardize the farm mechanization of ragi

Sr. No.	Items	Relevancy weightage	Relevancy percentage	Mean relevancy score	't' values
1.	Implements used for land preparation				
1.a	Primary tillage equipments				
	Wooden plough	0.73	73.33	2.20	2.18
	Tractor drawn MB plough	0.84	84.44	2.83	2.64
	Tractor drawn disc plough	0.80	80.00	2.64	3.35
1.b	Secondary tillage equipments				
	Tractor drawn cultivator	0.78	78.00	2.35	2.42
	Tractor drawn disc harrow	0.94	94.44	3.33	2.35
	Power tiller operated rotavator	0.74	74.44	2.43	2.56
	Tractor drawn rotavator	0.71	71.00	2.60	2.98
2.	Implements used for Sowing operations:				
	Broadcasting	0.87	87.00	3.51	2.61
	Line sowing	0.86	86.00	2.80	2.98
	Manually operated seed cum fertilizer drill	0.76	76.00	2.00	1.96
	Animal operated seed cum fertilizer drills	0.74	74.44	2.01	2.01
	Tractor operated seed cum fertilizer drill	0.99	99.00	3.47	3.07
	Drum seeder	0.78	78.00	2.62	2.62
3.	Implements used for seed covering methods:				
	Tractor drawn planers	0.72	72.22	2.34	2.34
4.	Implements used for Intercultural operations:				
	Varavaary (hand kurapi)	0.72	72.00	2.94	2.34
	Animal drawn blade harrow	0.77	77.00	2.64	2.94
	Tractor drawn blade Harrow	0.89	89.00	3.25	2.64
	Power weeders	0.89	88.00	3.35	3.25
5.	Implements used for spraying operations:				
	Foot operated sprayer	0.79	79.00	2.98	3.15
	Engine power operated sprayer	0.76	76.00	2.15	2.35
	Power tiller operated sprayer	0.70	70.00	2.18	2.18
	Tractor operated sprayer	0.79	79.00	2.65	3.35
6.	Implements used for harvesting operations:				
	Sickle	0.72	72.22	2.35	2.35
	Vertical conveyor reaper	0.83	83.33	2.84	2.84
	Combine harvester	0.82	82.00	2.00	1.97
7.	Implements used for threshing operations:				
	Animal drawn roller attached thresher	0.78	78.00	2.73	2.73
	Tractor traveled in rotation method at harvesting yard	0.78	78.00	2.35	2.35
	Power operated single crop thresher	0.82	82.00	2.00	1.98
	Power operated multi crop thresher	0.87	87.00	2.84	2.84
	CIAE multi millet thresher	0.87	87.00	2.94	2.94
8.	Implements used for cleaning operations:				
	Hand winnower	0.70	70.00	2.00	2.94
	Engine operated winnower	0.88	88.00	2.84	2.84
	Power operated ragi cleaner	0.89	89.00	2.83	2.83
9.	Implements used for milling operations:				
	Power operated milling machine	0.89	89.00	2.02	1.96
	CIAE millet mill	0.93	93.33	2.55	2.55
10.	Machineries used for transportation				
	Tractor with trailor	0.98	98.00	2.15	2.15

Mean relevancy score: 1.96-2.57 (5 % significance), $\geq$ 2.58(1% significance) and $\leq$1.96 (Not significant)

Table 2 : Relevancy weightage, relevancy percentage, mean relevancy score and 't' values for standardize the farm mechanization in maize

Sr. No.	Items	Relevancy weightage	Relevancy percentage	Mean relevancy score	't' values
1.	Implements used for land preparation				
1.a	Primary tillage equipments				
	Wooden plough	0.78	78.11	2.65	3.35
	Tractor drawn MB plough	0.71	71.00	2.16	2.18
1.b	Secondary tillage equipments				
	Tractor drawn cultivator	0.81	81.22	3.18	2.84
	Tractor drawn disc harrow	0.82	82.44	3.45	2.64
	Power tiller operated rotavator	0.71	71.00	2.00	2.35
	Tractor drawn rotavator	0.90	90.00	3.83	2.56
2.	Implement's used for sowing operations:				
	Line sowing	0.81	81.22	3.84	2.84
	Manually operated seed cum fertilizer drill	0.70	70.00	2.12	2.62
	Animal operated seed cum fertilizer drills	0.84	84.22	3.49	2.59
	Animal operated seed planter cum fertilizer drill	0.72	72.00	2.22	3.35
	Tractor operated seed cum fertilizer drill	0.77	77.22	2.58	2.84
	Tractor operated seed planter cum fertilizer drill	0.74	74.33	2.35	3.35
3.	Implements used for seed covering methods:				
	Animal drawn planers	0.78	78.33	2.83	2.83
4.	Implements used for intercultural				
	Varavaary (hand kurapi)	0.72	72.00	2.14	2.94
	Tractor drawn blade harrow	0.70	70.00	2.05	3.35
	Power tiller operated rotavator	0.76	76.11	2.38	2.18
	Power weeders	0.77	77.00	2.35	3.35
5.	Implements used for spraying operations:				
	Foot operated sprayer	0.71	71.00	2.04	3.04
	Power tiller operated sprayer	0.74	74.00	2.15	3.15
	Tractor operated sprayer	0.71	71.00	2.05	3.35
6.	Implement's used for harvesting operations:				
	Sickle	0.71	71.00	2.05	3.15
	Maize harvesters	0.83	83.22	3.20	2.15
	Combine harvester	0.93	93.22	3.45	2.00
7.	Implements used for threshing operations:				
	Pedal operated thresher	0.79	79.44	2.83	2.83
	Multi crop thresher	0.97	97.00	3.23	2.23
	Power operated maize sheller	0.99	99.00	3.67	2.07
8.	Implements used for Cceaning operations:				
	Hand winnower	7.01	70.00	2.02	2.62
	Engine operated winnower	0.82	82.00	3.23	2.23
9.	Implements used for milling operations:				
	Power operated milling machine	0.78	78.00	2.83	2.23
10.	Machineries used for transportation				
	Bullock carts	0.71	71.00	2.25	3.25
	Tractor with trailor	0.94	94.00	3.43	2.43

Mean relevancy score: 1.96-2.57 (5% significance), $\geq$ 2.58(1% significance) and $\leq$1.96 (Not significant)

group

X_L = The mean score on given statement of the low group

Σx^2_H = Sum of squares of the individual score on a given statement for high group

Σx^2_L = Sum of squares of the individual score on a given statement for low group

n = Number of respondents in each group

Σ = Summation

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

Based on the item analysis (t value), 7 implements were non-significant in ragi crop and 12 implements were non-significant in maize crop, 17 implements were significant at 5% level and 11 implements were significant at 5% at maize crop, the remaining 19 implements were significant at 1% level at ragi crop and 20 implements were significant at 1% at maize crop. These implements which were statistically significant were finally retained in the scale to measure the attitude towards farm mechanization.

Standardization of the items :

The developed scale will be reliable when it gives consistently the same obtained results when applied to the same samples of the research. The designed attitude scale for the research study was pre-tested for its reliability by using the split-half method used to find out reliability. Pilot study was conducted among 30 respondents in non-sample area comprising 36 implements from ragi crop and 31 implements from maize crop. The non sample area was selected Chickaballapura district in Karnataka State. In these non-sample area 31 members was selected for judging the implements to find out reliability. However, the split half method was employed to measure the reliability of implements. The value of correlation co-efficient was 0.9132 in ragi crop and 0.9138 in maize crop. This was further correlated by using Spearman Brown formula and obtained the reliability co-efficient of the whole test the 'r' value of the scale was 0.9546 in ragi crop and 0.9550 in maize crop and which is higher than the standard of 0.70 indicating higher reliability of the scale. However, which was highly were significant at 1% indicating the high reliability of statements.

Split-half test reliability formula :

$$r_{1/2} = \frac{N(\Sigma XY) - (\Sigma X)(\Sigma Y)}{\sqrt{[N\Sigma X^2 - (\Sigma X)^2][N\Sigma Y^2 - (\Sigma Y)^2]}}$$

where,

ΣX = Sum of the socres of the odd number items

ΣY = Sum of the scores of the even numbers items

ΣX^2= Sum of the squares of the odd number items

ΣY^2= Sum of the squares of the even number items

Whole test reliability formula (Spearman brown formula) :

$$r_{11} = \frac{2 \times r_{1/2}}{1 + r_{1/2}}$$

where,

$r_{1/2}$=Half test reliability

Validity formula :

$V=\sqrt{r}$

The validity co-efficient for the scale was 0.9770 in ragi crop and 0.9772 in maize crop which was also statistically significant at 1% of probability indicating the higher validity of the developed scale and which is greater than the standard of 0.70 Hence, the validity co-efficient was also found to be most appropriate. Hence, the developed scale to measure the attitude of members towards farm mechanization was found feasible and appropriate. All reliability and validity values of ragi and maize crop mechanization have been pertained at the Table 3.

Table 3 : Reliability and validity of the farm mechanization in ragi and maize crop

Sr. No.	Crop		Particulars	Values
1.	Ragi	Reliability	Split-Half ($r_{1/2}$)	0.9132
			Whole-test (RII)	0.9546
		Validity	Statistical Validity	0.9770
2.	Maize	Reliability	Split-Half ($r_{1/2}$)	0.9138
			Whole-test (RII)	0.9550
		Validity	Statistical Validity	0.9772

The effective agricultural mechanization contributes to the increase production and productivity in two major methods, firstly the timeliness of farm operations in farming and secondly the better quality of work. The requirement of farm power for certain agriculture operations like-wise land and bed preparation, cultivation practices and crop harvesting becomes so much of great that the existing manual power and animal power in country appears to be inadequate. As a consequent of inadequate manual and animal power, the farm operations are either partially done or sometimes completely neglected, the resulting in low yield due to backed up by poor crop growth or untimely farm operations like crop harvesting. Farm mechanization has been seen slow progress over the recent years. The demand of important farm equipments like farm tractors, power tillers, combine harvesters, pump sets, diesel operated engines has been shown increasing trend of machineries and it estimated to be growing at the rate of 1 to 1.5% year^{-1}. Yet Indian agriculture lacks farm power which needs to be increased from 1.25 kW ha^{-1} to at least 2.00 kW ha^{-1}. If the Indian farmers used proper machineries in farming means definitely Indian agricultural scenario can be change lot in both productivity and production.

Conclusion :

It can be concluded that the standardization practices were useful in explicitly measuring the increase knowledge level and create more awareness towards farm mechanization in ragi and maize crop at both dry land and irrigated farming.

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