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Mohd Riaz
Department of Agricultural Extension, GKVK, University of Agricultural Sciences Bangalore, Karnataka, India

Raghupathi D
Associate Director of Extension, University of Agricultural Sciences, ZARS, V.C. Farm, Mandya, Karnataka, India

Venkatesh M
Associate Director of Extension, University of Agricultural Sciences, ZARS, V.C. Farm, Mandya, Karnataka, India

Corresponding Author:
Mohd Riaz
Department of Agricultural Extension, GKVK, University of Agricultural Sciences Bangalore, Karnataka, India

A study on analysis of gap in technology application and participation in extension activities of redgram (*Cajanus cajan* L. Millsp) growers in Karnataka, India

Mohd Riaz, Raghupathi D and Venkatesh M

Abstract
The selected topic for the research is contextual on the occasion of International Year of Pulses 2016, The United Nations General Assembly theme, mandated by FAO Rome [3]. The northern part of the Kalaburgi and Bidar districts are known as "Pulse bowl of Karnataka". The study was conducted in Bidar district as it had large area under Redgam crop during 2017-18. The objectives of the study were, to find out the extent of gap in application of improved technologies of production and to find out the association between participation in extension activities and technology application gap. Three taluks Aurad, Bhalki, and Basavakalyan were selected with total sample size 120 respondents. The instrument for data collection was developed and administered to the respondents. The *Ex post facto* research design was adopted. The dependent variable was 'Gap in application of technologies' and the independent variable was 'Participation in extension activities'. Appropriate statistical tools were employed to analyse the data. Study found that the gap in technology application was to the extent of 20.20% and partial application was to the extent of 19.00% among the growers. The gap was more conspicuous in case of technological practices of seed rate, seed treatment, spacing, transplanting, nipping operations, application of Farm Yard manure, herbicide and fertilizer applications. Non-availability good quality inputs timely, at affordable price were the constraints in application of good agricultural practices by the growers. Majority of the growers did not participate in the extension activities and programs organised by the formal extension agencies; because of less number of Redgram extension programs organised and less opportunities for the growers to participate. The variable Participation in extension activities had non-significant association with gap in application of technologies inferring that the participation in extension activities did not reduce the gap application of improved production technologies.

Keywords: Pulse bowl of Karnataka, gap in application of technologies, extension participation, cost benefit ratio, recommended technologies

Introduction
The United Nations General Assembly declared the year 2016 as the International Year of Pulses to raise awareness about the importance of these crops and highlight their nutritional value (protein) in healthy diets, their contribution to soil health and the environment contributing to towards the achievement of the 2030 Agenda for Sustainable Development and the Sustainable Development Goals (FAO, 2016) [3]. The pulses are by and large daily item of food menu for Indians. The major pulse crops include dicot grams such as Green, Black, Red, Bengal and Horse grams and also Cowpea, Peas so on. The Redgram crop (*Cajanus cajan* L. Millsp.) is a protein rich food and consumed in the form of split dal. Besides, as a fodder, the green leaves and dry seeds of Redgram are used as fodder for animals. Towards this, there is a need to initiate mission mode strategic action plans to increase the yield productivity and its equitable distribution to address the hungry and malnutrition, especially Asian and African countries. The average productivity was 7.60 q/ha, with per capita availability of 19.9 kgs/year in India (*Agripedia.com* 2011) [1]. Majority of Indians are vegetarians and on an average they consume 70 to 80 grams of pulses per day.

In Karnataka State of Indian union, it was being grown in an area of 7.70L. ha area with production of 3.50Mt with average productivity of 4.82q/ha (GoK,2015) [2]. Large area is occupied with high production supplies from the North-East Karnataka region, the Kalaburgi and Bidar districts called as "Pulse bowl of Karnataka".

The study was conducted during 2017 in Bidar district of Karnataka as there was large area under Redgram crop. The lower productivity of Redgram in the region was due to many factors such as scanty rainfall, timely non-availability of labour timely, least application of production technologies, socio-economic conditions of growers etc. Further, the insect

menace, the pod borer (*Helicoverpa armigera. L*) in endemic proportion causing huge grain yield loss (Nikhade *et al.* 1997) [6]. The Farm Universities have developed a package of improved technologies for the application as to address the production problems. There was a need to transfer the technologies by the extension functionaries to the farmers by following a philosophy of 'friend, philosopher and guide'. There are multiple extension players catering the extension services to provide input supply and advisory services. The Indian formal extension systems are Ministry of Agriculture and Farmers' Welfare, Indian Council of Agricultural Research through its Krishi Vigyan Kendras at district level, Karnataka State Department of Agriculture, through its Raitha Samparka Kendras at hobble level (centre for cluster of villages); The Farm Universities also rendering extension service to the farmers through their Extension Directorate of Extension Units. There are statutory institutions, such as Farmers Cooperatives, Private agencies, Farmers organisations, input agencies and individual level also the extension services are being rendered for the benefit of farming community. Apart from these there are informal sources also catering and diffusing the farm technologies through friends, relatives, progressive farmers etc. Among these, the Redgram growers are making use of the extension services.

The Statement of the problem of the study is low grain yield productivity existed Bidar district when compared to the National grain yield productivity. There was a less supply and unequal distribution of pulses to the weaker sections of the Indian society, 38.4% of children under five in India are stunted, while 51.4% of women in reproductive ages are anaemic (UN report 2017) [12]. When there are improved technologies available in the Farm Universities, why the growers did not apply them?. There is a need to understand and find out the underlying constraints. Further, with respect to extension services, what extent they were participating in the extension activities organised by the formal and informal extension agencies to acquire technical knowledge & skills and their application?. If the growers had participated, in the extension activities, was there any influence on, in reducing the gap in application of recommended improved technologies?. From this backdrop, twin objectives were set to investigate. The objectives of the study are to find out the extent of gap in application of improved technologies of production and **t**o find out the association between participation in extension activities and technology application gap.

Methodology

The research study was carried out in the Bidar district of Karnataka State, which consists of five taluks, out of which three taluks viz.,Aurad, Bhalki and Basavakalyan were selected by considering the large area under Redgram cultivation. The sample size was 120. The respondents were selected by random sampling procedure (Table-1).

Table 1: Study area and sample size: Bidar district Karnataka State

Sl. No	Taluks	Villages	No. of Respondents
1	Aurad	Mudhol	20
		Ekamba	20
2	Bhalki	Khatakchincholi	20
		Halbarga	20
3	Basavakalyan	Ujalamb	20
		Narayanpur	20
		Total	120

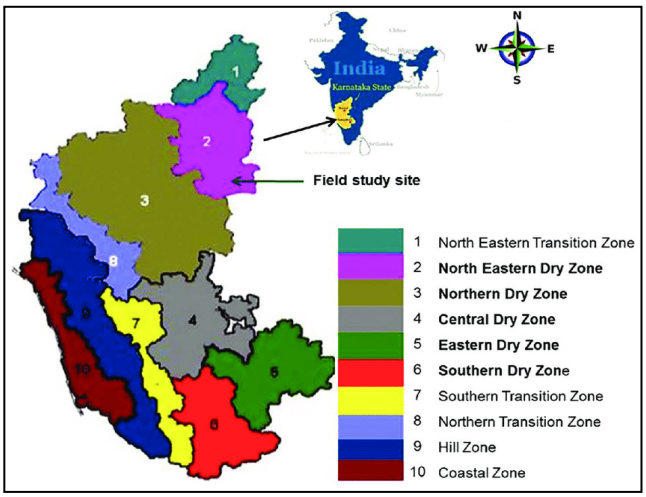

Fig 1: Study area, Agro-climatic zones of Karnataka

The Research design adopted was *Ex-post facto* research, exploratory type was used (Kerlinger, 1973) [4].

The Variables served for the study are one dependent variable and one independent variable. The Dependent variable is "Gap in application of technologies" of respondents. The independent variable is Participation in extension activities. The Operational definition of dependent of variable Gap in application of technologies it is a extent of gap in application of improved technologies of Redgram production recommended by the Farm University and the technologies actually being practiced by the respondents.

The Alternate hypothesis of the study was there would be more gap (> 50%) in technology application of Redgram production and Second alternate hypothesis is there would be a significant association between the extension participation of Redgram growers with the dependent variable Gap in application of technologies. Measurement of Dependent variable Gap in application of technologies is difference between the package of improved practices of Redgram cultivation recommended by Farm Universities and the extent of application of these practices by the farmers. The package of recommendations were: Preparatory tillage, Recommended varieties, Sowing time, FYM / compost application, Seed rate, Seed treatment, Seed spacing, Transplanting, Application of fertilizers, protective irrigation, Nipping operation, Application of herbicides, Plant protection measures undertaken and Harvesting & threshing. These technological applications were measured by seeking information from the respondents on three point continuum scale; full, partial and not applied. A nominal score of 3, was awarded for full application, 2 for partial application and 1 for not application of recommended practice.

The Dependent Variable Gap in application of technologies was measured by using a scale developed by Ray *et al.* (1995) [10], with sight modifications

The per cent gap in technology application for each selected major practice was worked out with the help of following formula:

$$\text{Gap in application of technologies (Practice wise)} = \frac{\text{Standard score - Actual score}}{\text{Actual score}} \times 100$$

On the basis of overall Gap in application of technologies, the respondents were categorized into three categories viz., No Gap, Partial Gap and Gap considering the mean and standard deviation score obtained as measure of check.

Table 2: Minimum score 14 and maximum score 42.

Category	Criteria	Obtained score range
Gap	< (Mean – ½ SD)	>28
Partial Gap	(Mean ± ½ SD)	29 to 32
Gap	> (Mean + ½ SD)	>33

The independent variable the Extension participation was selected which is likely to have influence on the dependent variable Gap in application of technologies. The Operational definition is, involvement of respondents by attending in the extension activities, programs organised by Extension agencies (formal and informal institutions) for technology acquiring and application.

The Independent Variable Extension participation was measured by adopting a Procedure followed by Rajashekhar (2009) [8] and Sakharkar (1995) [11], with slight modifications.

The procedure was assigning nominal score to the items listed under extension participation. The information was sought from the respondents regarding participation in extension activities on three point continuum, Regular, Occasional and Never. A nominal score of 3, 2 and1 were awarded correspondingly. The score obtained by the respondents was compared with maximum score possible. There were 'open end' type of questions to elicit detailed information from the respondents.

Considering the objectives of the study a structured interview schedule was prepared by seeking advice of experts and pre-tested in non-sample area and modifications were incorporated. An apparent of content validity of all the items was ensured before the interview schedule was finalised. The data were collected from the selected respondents visiting the villages of the Bidar district during 2017. The interview schedule was administered to the respondents and oral information and opinion expressed by oral and memory was documented. The visual observations were made accordingly. While collecting information care was taken to avoid onlookers' influence and group pressure on the respondent to ensure pertinent information. The Participatory Rural Appraisal tools such as Focus Group Discussions and Transact walk were also used to supplement the data wherever required. The secondary sources reports and records were referred from the developmental departments. For analysing the data the statistical tools such as frequency, percentage, mean, standard deviation and Non-parametric 'Chi square' test were used to draw the inference.

Results and Discussion

With respect to extent of Gap in application of improved technologies of Redgram production, the study found that majority of the respondents (60.20%) applied the recommended technologies which are simple, economical, socio-culturally compatible. However, there were 1/5th of the respondents did not apply as they were complex, required more labour and costly. Some of the respondents (19.0%) applied partially (Table-3), as they were and costly, inaccessible and were not available in-time. Further, the new technologies like transplanting and nipping were not applied by many of them because they were not aware and lack of skills in application. Some of the technologies like seed rate and spacing were applied more than the recommended with wrong perception that more seeds sowing and closure spacing give more yields. The finding was in conformity with the results of Ranish *et al*. (2001) [9].

Table 3: Technology Practice-wise application gaps in Redgram cultivation

(n=120)

Sl. No.	Cultivation Practices	No Gap (%)	Partial Gap (%)	Gap (%)
1	Preparatory tillage (Deep ploughing and pulverising the soil)	120 (100.00)	0.00	0.00
2	Recommended varieties (Hyd-3C, TTB-7, ICP-7035, BRG-1, 2, 4, 5.	102 (85.00)	0.00	18 (15.00)
3	Sowing time	96 (80.00)	0.00	24 (20.00)
4	FYM/Compost application (3tons/ha with Trichoderma).	38 (32.00)	50(42.00)	32 (26.00)
5	Seed rate (15kgs/ha)	43 (36.00)	77 (64.00)*	0.00
6	Seed treatment (Sodium molybdate with melted jiggery solution & biofertilisers, Rhizobium and PSB).	43 (30.00)	0.00	77 (70.00)
7	Spacing (60x20cm)	28 (23.00)	0.00	92 (77.00)
8	Transplanting (Dibbling)	22 (18.00)	0.00	98 (82.00)
9	Use of Fertilizers (25-50-25kg NPK/ha)	0.00	115 (96.00)	5 (4.00)
10	Irrigation (protective irrigation twice flower and pod stages)	28 (23.00)	0.00	92 (77.00)
11	Nipping operation	30 (25.00)	0.00	90 (75.00)
12	Herbicides application (Pendimethalin 1day after sowing)	16 (13.00)	0.00	104 (87.00)
13	Plant protection measures (IPM)	6 (5.00)	65 (54.00)	49 (41.00)
14	Harvesting & Threshing using small machines (Tools and Small machines)	98 (82.00)	10 (8.00)	12 (10.00)
Total responses		670	317	693
Score (continuum) assigned		3	2	1
% Application		60.20	19.00	20.80

*Applied more than the recommended (6 to 10kgs/ac).

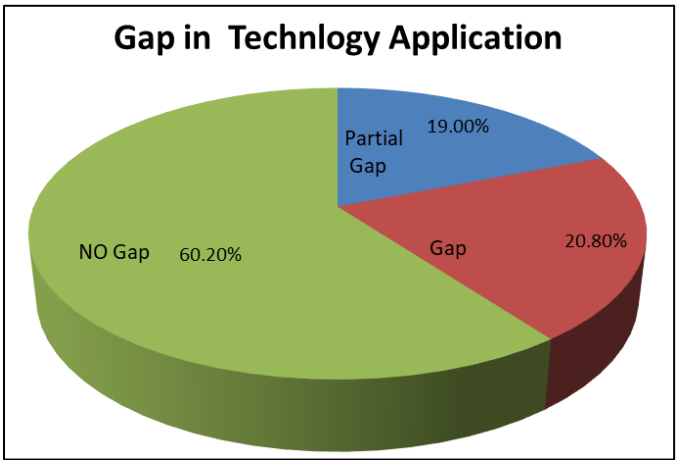

Fig 2: Extent of gap in technological application, Redgram cultivation practices

The application of recommended technologies by the respondents was 66.20 percentage and Gap in application (not applied) was only 20.80% (Table-3 and Fig-2). The alternate hypothesis of more gap (>50%) in application of technologies is rejected as there was less gap among the respondents.

Participation in extension activities

Majority of the respondents (80%) did not participate in the extension activities organised by the formal extension agencies (Table-4). A few of them participated occasionally. (Table-4 & Fig-3) There might be less opportunities to participate in the extension activities organised by the formal organisations. The findings were in agreement with the findings of Wondangbeni (2010) [13].

Table 3: Distribution of respondents according to their extension participation

(n = 120)

Sl. No.	Extension Activities	Extent of participation					
		Regular		Occasionally		Never	
		No	%	No	%	No	%
1	Seminars/ talks	0	0.00	3	2.50	117	97.50
2	Group meetings	4	3.33	3	2.5	113	94.16
3	Demonstrations	5	4.17	2	1.67	113	94.16
4	Trainings	5	4.17	5	4.17	110	91.67
5	Field trips	10	8.33	9	7.50	101	84.17
6	Field day	34	28.33	23	19.16	63	52.50
7	Krishimela	50	41.67	23	19.16	47	39.17
8	Other programs (FFS, Krishi bhagya etc.).	10	8.30	60	50.00	50	41.66
	%		12.0		8.00		80.0

Mean = 1.13 SD = 0.94

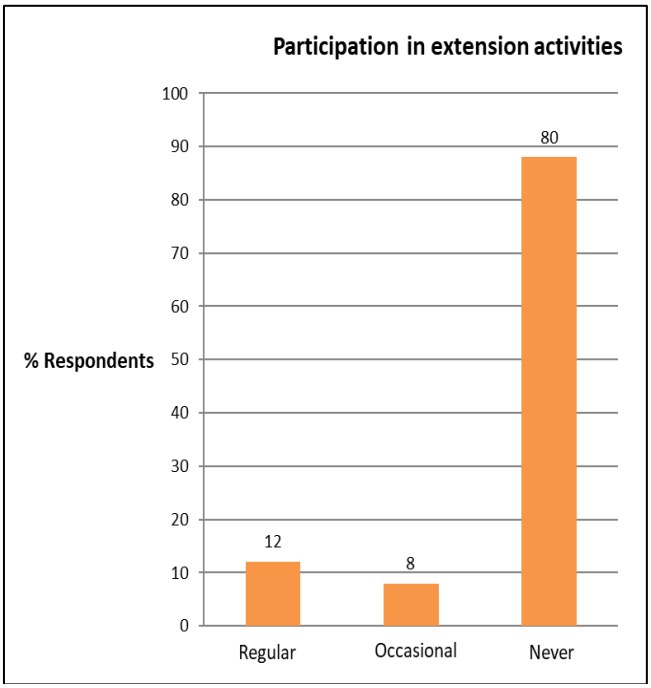

Fig 3: Participation in extension activities by the respondents

Association between sources of information sought and the Technology application gap

The variable Extension participation had a non-significant association with gap in application of technologies (Table-4), inferring that the regular participation in the extension activities did not influence in reducing the Gap in application of technologies. The plausible reasons could be less opportunities for the growers to participate in the extension activities and programs organised by the formal extension agencies. The contact with extension functionaries was less and if they participated, they might have perceived as less useful to them. Further, they might have relied more on the informal input agencies and private extension agencies for input supplies and advisory services, who are available nearby

Table 4: Association between participation in extension activities and the Technology application gap

Chi square test n=120

Participation in extension activities	Gap in application of technologies (No)				
	Gap	Partial Gap	No Gap	Total	Test value
Never	38	12	39	**89**	χ^2 =1.28 NS
Occasional	5	6	5	16	
Regular	5	5	5	15	
Total	48 (40.00)	23 (19.0)	49 (41.00)	120 (100.00)	

NS: Non-significant Association. (Figures in the parentheses indicate percentage)

Regarding Cost benefit ratio the Average grain yield of Redgram obtained by the respondents was 5.75q/ha, against the possible yield of 13.50 q.ha when applied all the recommended technologies. The average net returns obtained was Rs. 10,963/ha. The returns per rupee investment was 1.81, indicating a marginal profit (Table-5). The less grain yield was due to partial and non-application of recommended technologies.

Table 5: Cost Benefit analysis of Redgram cultivation

(n=120)

Average grain yield (q /ha)	Average cost of production (Rs/ha)	Average gross returns (Rs. /ha)	Average net returns (Rs/ha)	C: B ratio
5.75	6040.81	17004.17	10963.36	1: 1.81

Conclusion

The study found that the gap in technology application was existing to the extent of 20.20% and partial application was to the extent of 19.00%. among the growers. The gap was more conspicuous in case of technological practices of seed rate, seed treatment, spacing, transplanting, nipping operations, application of FYM, herbicide and fertilizer applications. As a consequence the actual grain yield obtained was less, because of non-application of improved agricultural practices recommend by the Farm Universities and research agencies. Non-availability good quality inputs timely, at affordable price were the constraints in application of good agricultural practices by the growers. Majority of the growers did not participate in the extension activities and programs organised by the formal extension agencies. The plausible reasons could be less number of Redgram extension programs organised and less opportunities for the growers to participate. The variable Participation in extension activities had non- significant association with gap in application of technologies inferring that the participation in extension activities did not reduce the gap application of improved production technologies. Further, the growers had less contact with extension functionaries from formal extension organisations and more contact with informal extension sources for technological input supplies and advisory services. The Implications of the study being, there was a Gap in application of technologies such as seed treatment, spacing, application of FYM, fertilizer application and seed rate. One of the effective ways to overcome this is to utilizing the scientific expertise from the formal extension feeder institutes located at gross root level, such as Krishi Vigyan Kendras for conducting regular off- campus training for the farmers. Organising Farmer's Field Schools at cluster village centres. Enabling the field staff to spend more time in advisory services from Raith Samparka Kendras. Formation of Commodity Associations, Farmer Produce Organisations and organising the extension programs through them would ensure better participation of growers in the extension activities and programs. Strengthening informal service providers, encouraging progressive farmers as parallel extension workers, inclusion of input and the private extension agencies in to the national extension main stream for diffusion of farm technologies go long way to reduce the gap in application of improved technologies.

Annexure

Distribution of respondents according to their Extension contact

(n = 120)

Sl. No.	Extension personnel	Regular		Occasionally		Never	
		No	%	No	%	No	%
Formal contact sources							
1	Assistant Agricultural Officer	0	0	0	0	120	100.00
2	Agricultural Officer	0	0	0	0	120	100.00
3	University Scientists	0	0	20	16.67	100	83.33
4	Assistant Horticulture Officer	0	0	0	0	120	100.00
5	Veterinary Officer	0	0	70	58.33	50	41.67
6	Assistant Director of Agriculture	0	0	0	0	120	0.00
	Total formal (score assigned)	0	0	90 (90x2=180)	0	30 (30x1=30	210
B	Informal sources (Progressive farmer, neighbours, input agencies, private consultancy etc).	95 (95x3=285)	79.17	20 (20x2=40)	8.33	05 (5x1=5)	4.17 330

Mean = 1.35 SD = 0.64

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