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Technology Application gaps and Constraints in Redgram (*Cajanus cajan* L. Mill sp.) Production in Karnataka, India

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A B S T R A C T

The research study was conducted in Bidar district of Karnataka during 2017-18. The objectives of the study were, finding the extent of technology application gap of improved cultivation practices of production and to find out the relationship between socio-economic variables with the technology application gap. Appropriate research methodology was adopted. Findings indicated 20.20% production technology application gap and 19% partial application was found among the growers. The independent variables such as farming experience, innovative proneness, social participation and economic status, had positive significant relationship with technology application gap the remaining variables had non-significant relationship. Non-availability of good quality inputs timely and at affordable price were the main constraints in application of recommended technologies.

Introduction

Realising the nutritional importance of pulses contribution to health nutrition, soil health and environment, the United Nations General Assembly declared 2016 as the International Year of Pulses, towards the achievement of the 2030 Agenda for Sustainable Development (FAO, 2016). India is importing pulses to address the hungry and malnutrition, the average grain productivity was 7.60 q/ha, with per capita availability of 19.9 kgs/year (Agripedia 2011). 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). Large cultivable area is in the North-East Karnataka region, the Kalaburgi and Bidar districts called as "Pulse bowl of Karnataka". (Mt=Million tons, q/ha=quintals per hectare.). The study was conducted during 2017-18 in Bidar district of Karnataka as there was large area under Redgram crop. The farm Universities have developed a package

of improved technologies for the application as to address the production problems.

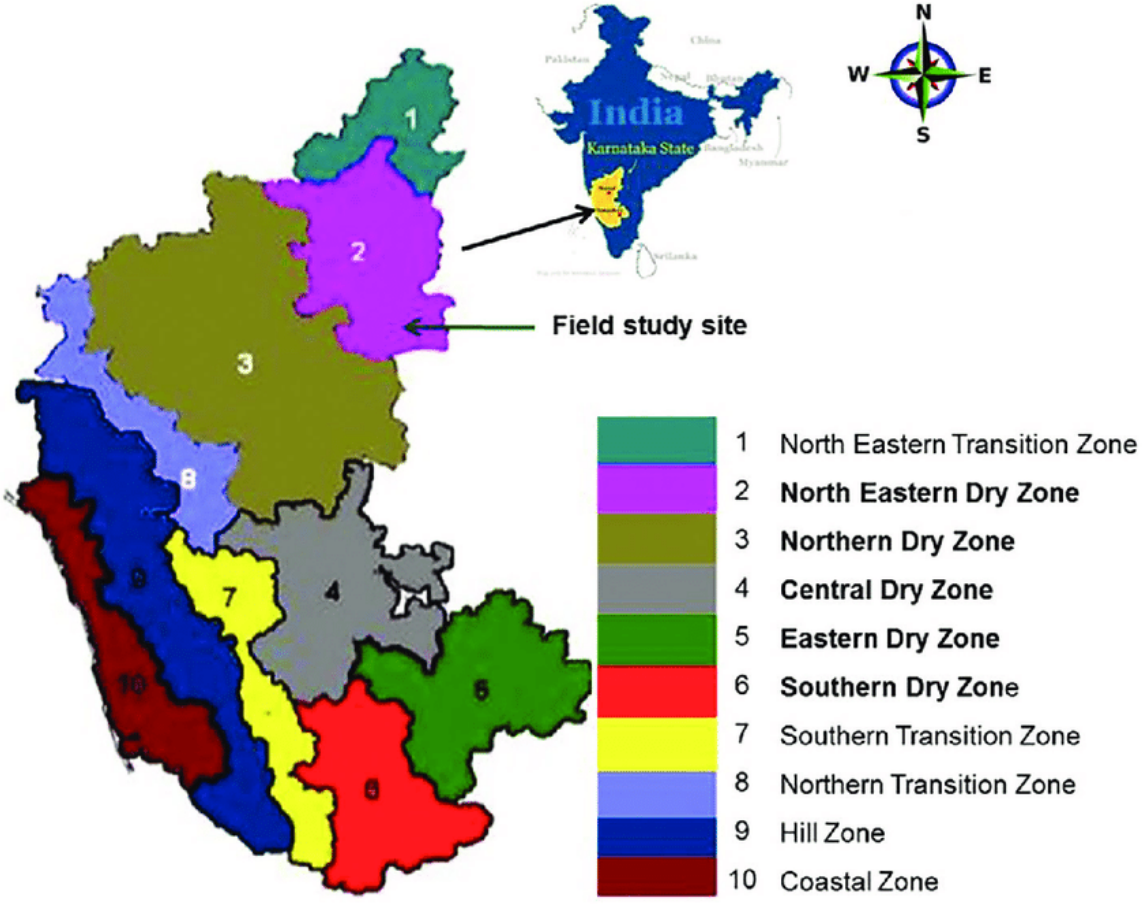
Statement of the problem

There was low grain yield productivity in Bidar district when compared to the National grain yield productivity. The research questions were; when there were improved recommended technologies available in the Farm Universities, not many of growers applied them why?. What was the extent of application gap?, Which were the underlying constraints in application?. These queries were to be investigated to develop an strategic action plan and frame policies to increase the grain yield productivity. The objectives of the study are to find out the extent of technology application gap of improved technologies of production and to find out the socio-economic and psychological factors contributing for the Technology application gap.

Materials and Methods

Study area and sample size

The Bidar district of Karnataka State consists of five taluks, from these three taluks namely 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.



Source: Census India 2011

Figure.1 Research study area

Research design

Ex-post facto research, exploratory type was used (Kerlinger, 1973). The Variables for the study, the Dependent variable is "Technology application gap" of respondents. The independent variables are Education, Land holding, Farming experience, incentives received from Govt., Innovative proneness, Social participation, scientific orientation and Economic status of respondents.

The Operational definition of dependent of variable "The Technology application gap" is defined as 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 for production. The Hypothesis of the study, The alternate hypothesis set for the study there would be more gap (> 50%) in technology application of Redgram production, there would be a contribution indicating significant relationship between the selected socio-economic and psychological independent variables and the dependent variable "Gap in application of technologies" of the respondents.

Measurement of dependent variable technology application gap

It 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 growers. The package of recommendations were: Preparatory tillage, Recommended varieties, Sowing time, FYM or 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 Technology application gap was measured by using a Scale developed by Ray *et al.*, (1995) with slight modifications. The per cent gap in technology application for each selected major practice was worked out with the help of following formula:

$$\text{Technology application gap (Practice wise)} = \frac{\text{Standard score - Actual score}}{\text{Actual score}} \times 100$$

On the basis of overall Technology application gap, 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.

Category	Criteria	Obtained score range
Gap	< (Mean – ½ SD)	>28
Partial Gap	(Mean ± ½ SD)	29 to 32
No Gap	> (Mean + ½ SD)	>33

Minimum score 14 and maximum score 42

Independent variables and their measurement

The following independent variables were selected which are likely to have relationship with the dependent variable 'Technology application gap'. These were measured by adopting the procedure given by the authors, with slight modifications wherever necessary.

Sl. No	Variables	Empirical measurement
A.	**Dependent variables**	
1.	Technological gap	Scale developed by Ray *et al.*, (1995) with slight modifications
B.	**Independent variables**	
1.	Education	Procedure followed by Shashidhara (2003).
2	Land holding	Procedure followed by Maraddi (2006) with slight modifications.
3	Farming experience	Procedure followed by Binkadkatti (2008)
4.	Incentives received from Govt.	Consisted of close and open end type with Face validity content items.
5	Innovative proneness	Scale developed by Feaster (1968)
6	Social participation	Scale developed by Saravanakumar (1996) with slight modifications.
7	Scientific orientation	Scale developed by Supe (1969) with slight modifications.
8	Economics status	Procedure followed by Prakash (2000)

Each independent variable was measured as per the procedure outlined by the authors. The procedure as, assigning nominal score to the items listed under each variable on a three point continuum of "agree, dis-agree ad neutral" and also seeking dichotomous responses for the questions asked. A nominal score '2' for Yes and '1' for No were awarded and measured. The score obtained by the respondents, against the maximum score possible was calculated and categorised in to hierarchically.

Data collection and analysis

Developing interview schedule and data collection it was developed by considering the objectives of the study a structured interview schedule was prepared in a way that the objectives were to be realised; 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 2017-18. The interview schedule was administered to the respondents and oral information and opinion expressed by oral and from 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.

The Statistical tools and tests used for data analysis are frequency, percentage, mean, standard deviation and Non-parametric test of Kendal's correlation coefficient were used to find out relationship between independent variables and dependent variable and to draw an inference.

Results and Discussion

The results are discussed as per the objectives of the study to find out the extent of gap in application of improved technologies of production and to find out the socio-economic and psychological factors contributing for the Technology application gap.

Extent of technology application gap of improved technologies of redgram production

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-1), 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).

The application of recommended technologies by the respondents was 66.20 percentage and the Gap in application (not applied) was only 20.80 per cent (Table-1 and Graph). The alternate hypothesis of more gap (>50%) in application of technologies is rejected as there was less gap among the respondents.

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 were 1.81, indicating a marginal profit (Table-2). The less grain yield was due to partial and non-application of recommended technologies.

(n=20)

Sl. No	Indicators	Components	F	%
A	Farm power	Wooden plough	63	52.50
		Iron plough	65	54.20
		Seed drill	45	37.50
		Tiller	08	6.70
		Sprayer	60	50.00
		Tractor	12	10.00
B	Material possession	Radio	25	20.80
		Television	104	86.70
		Bi-Cycle	78	65.00
		Pump set	30	25.00
		Two wheeler	48	40.00
		Four wheeler	06	5.00
C	House (Dwelling)	Mud walled thatched	57	47.50
		Brick walled tiled	47	39.20
		Concrete house	10	8.30
		Concrete double storied	06	5.00

Mean = 11.04 SD = 3.93

Economic Status

The independent variables and their categories the respondents were distributed in all the categories of High Medium and Low (Table-3).

Relationship between independent variables and technology application gaps

Relationship between education and technology application gap

The Table-4 reveals that there was non-significant relationship between education and Technology application gap (r-0.026). The reasons could be the higher education level had not influenced in higher gaining knowledge and skills in application of technologies, where normally the farming does not require higher education to profess agriculture. The alternate hypotheses of significant relationship between the two variables are rejected and the null hypothesis of non-significant relationship is accepted.

Relationship between land holding and technology application gap

The Table-4 reveals that there was non-significant relationship between Land-holding and Technology application gap (r-0.052). The reasons could be the possessing more lands had not influenced in gaining of higher knowledge and skills in application of technologies. Implying there was not much difference between big farmers and the small farmers as both of them applied the technologies almost equally. The alternate hypotheses of significant relationship between the two variables are rejected and the null hypothesis of non-significant relationship is accepted.

Relationship between farming experience and technology application gap

The variable Farming experience had a significant relationship (r=0.21) with the technology application gap (Table-4). The reason might be due to the longer a farmer is engaged in farming of a particular crop, the more knowledge and skills one would gain confidence in application of technologies efficiently. The experience teaches how to overcome risks and uncertainties. The alternate hypotheses of significant relationship between the two variables were accepted and the null hypothesis on non-significant relationship was rejected.

Relationship between incentives received from government and technology application gap

The variable Incentives received from Govt., had a non-significant relationship (r=0.085) with the technological gap (Table-4). The reason could be the incentives received were not used for farming and may be utilised for social and religious functions.

Further, the incentives might not have been used for investing in Redgam cultivation and might have received un-timely during the lean season. The alternate hypotheses of significant relationship between the two variables are rejected and the null hypothesis of non-significant relationship is accepted.

Relationship between innovative proneness and technology application gap

The variable innovative proneness significant relationship (r=0.13) with technology application gap (Table-4). The farmers who had high innovative proneness venture to take risk even there could be failures in application of technologies. The findings of the study are in consonance with the results of Santosh Swamy (2006). The alternate hypotheses of significant relationship between the two variables are accepted and the null hypothesis is rejected.

Relationship between social participation and technology application gap

It is observed that there was a significant relationship (r=0.21) between social participation and technological gap (Table-5). This might be due to higher and better social contacts with other progressive farmers, associations, institutions might have exposed them to acquire more knowledge and skills and go ahead 'do it oneself' feeling with application new technologies, proving worthy in society. The findings are in line with Mercy Kutty (1997). The alternate hypotheses of significant relationship between the two variables were accepted and the null hypothesis was rejected.

Relationship between scientific orientation and technology application gap

There was a non-significant relationship (r=0.097) between scientific orientation and technology application gap (Table-4). This might be due to strong belief in traditional customs, superstitions and less belief in scientific applications in cultivation of crops. Often this kind of less orientation towards scientific applications, bars the individuals to approach the extension organisations for information seeking and suspect the extension functionaries. The alternate hypotheses of significant relationship between the two variables are rejected and the null hypothesis of non-significant relationship is accepted.

Relationship between economic status and technology application gap

The Economic status had a significant relationship (Table-4) with technology application gap (r=0.192). The plausible reasons could be better economic status facilitates to procure the inputs and resources timely and managing the crop. The results are in line with the findings of Nikhade *et al.*, (1997), Nagabhushanam and Kartikeyan (1998) and Sulaiman and Prasad (1993). The alternate hypotheses of significant relationship between the two variables are accepted and the null hypothesis is rejected. The Table-4 reveals that the variable such as the, farming experience, innovative proneness, social participation, economic status had positive and significant relationship with technology application gap at five per cent level of significance and remaining variables had non-significant relationship.

Constraints as perceived by the respondents expressed for gaps in application of technologies

Input constraints

The Table-5, reveals that non availability of labours at critical stages of the crop growth & high wages this could be due to migration of labours to nearby industrial cities and most of the young generation gets engaged in non-agricultural operations.

Technical constraints

Non-availability of timely expertise advisory services and less competency of field extension personnel to advise the growers. Less competent in diagnosis facilities, on the spot solution providers.

Marketing constraints

Unpredictable price fluctuation, the price of Redgram depends upon various factors like consumers demand, export and import in national and international market, quantity of production and consumers surplus. Interference of middlemen's and there are no proper storage facilities nearby taluk places. The present findings were in accordance with the results reported by Bhogal (1994), Saravanakumar (1996), Raghavendra (2007), Wondangbeni (2010) and Rajashekhar (2009).

Table.1 Technology Practice-wise application gaps in Redgram production practice (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)

Table.2 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

Table.3 Independent variables and categories (n=120)

Sl.No	Characteristics	Category	f	%	Mean	SD
1	Education	Illiterate	27	22.50	2.04	1.76
		Primary school	13	10.80		
		Middle school	21	17.50		
		High school	24	20.00		
		Diploma/ ITI	15	12.50		
		Pre-University	13	10.80		
		Graduate	7	5.90		
		Total	**120**	**100.00**		
2	Land holding	Marginal farmers	10	8.50	8.18	4.84
		Small farmers	40	33.50		
		Medium farmers	65	54.00		
		Big farmers	5	4.00		
		Total	**120**	**100.00**		
3	Farming experience	Less	25	20.83	9.54	12.82
		Medium	39	32.50		
		More	56	46.67		
		Total	**120**	**100.00**		
4	Incentives received from Govt., (Rs.Range).	<1000 Rs.	30	25.00	1.39	0.85
		1000-5000 Rs.	40	33.30		
		5000-10000 Rs.	10	8.30		
		>10000 Rs.	5	4.20		
		Not received	35	29.20		
		Total	**120**	**100.00**		
5	Innovative proneness	Low	27	22.50	8.20	1.99
		Medium	53	44.20		
		High	40	33.30		
		Total	**120**	**100.00**		
6	Social participation	Low	34	28.30	0.86	0.66
		Medium	65	54.20		
		High	21	17.50		
		Total	**120**	**100.00**		
7	Scientific orientation	Low	39	32.50	9.33	1.86
		Medium	62	51.70		
		High	19	15.80		
		Total	**120**	**100.00**		

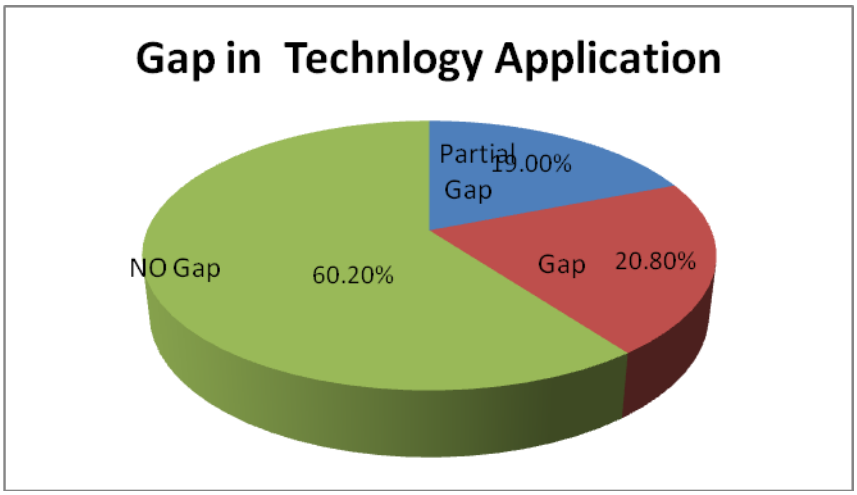
Table.4 Relationship between the independent variables of Redgram growers with their technology application gap (n = 120)

Sl. No.	Independent variables	Correlation co-efficient (r)
1.	Education	0.026^{NS}
2.	Land holding	0.052^{NS}
3.	Farming experience	0.216*
4.	Incentives received from Govt.	0.085^{NS}
5.	Innovative proneness	0.130*
6.	Social participation	0.213*
7.	Scientific orientation	0.097^{NS}
8.	Economic status	0.192*

*Significant at 5% level **Significant at 1 % level NS Non-significant

Table.5 Constraints in application of recommended good agricultural practices of Redgram cultivation as perceived by the respondents (n=120)

Sl. No.	Constraints	f	%
A. Input constraints			
1	High wages & non-availability labourers	78	65.00
2	Lack of financial assistance in time from government during droughts and floods.	72	60.00
3	Non-availability of good quality of inputs at affordable price in the market	72	60.00
B. Management constraints			
4	Inadequate irrigation facility-protective irrigation	65	54.16
5	High incidence of pests and diseases & its high management (Chemicals).	55	45.83
C. Technical constraints			
6	Lack of advisory services; technical guidance	15	12.50
D. Marketing constraints			
8	Skewed market price and low support price from Govt.	95	79.16
9	Distant location of Market places	69	57.50
10	Middleman's threat at the market centre	30	25.00
11	No proper storage structures nearby taluk places	27	22.50



Graph.1 Extent of technological application gap

Suggestions by the respondents: Supply of good quality of inputs at right time through Government institution and private agencies. Construction of warehouse facilities created nearby, storage facility helps them to store and hold the produce during market glut and enable the farmers to fetch better price. Provide water conservation technologies those are helpful during uncertainty and uneven distribution of rainfall.

Providing timely technical guidance, regarding recommended seed rate, seed treatment and application of pesticides & fertilizer by the experts. Establishment of rural markets at nearby places. To provide high grain yielding and pest resistance varieties of pod borer and wilt disease resistance varieties. Provide timely credit from cooperative societies and nationalized banks to purchase the inputs and resource management.

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 Farm yard manure, 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. The independent variables such as farming experience, innovative proneness, social participation and economic status, had positive significant relationship with technology application gap the remaining variables had non-significant relationship. Non-availability of good quality inputs timely and at affordable price was the main constraint in application of technologies.

The Implications of the study are; the Technology application gap can be addressed by utilizing the scientific expertise from the formal extension feeder institutes located at gross root level, such as Krishi Vigyan Kendras at gross root level for conducting regular off- campus training for the farmers. Organising Farmers' Field Schools at cluster village centres. Enabling the field staff to spend more time in advisory services from Raith Samparka Kendras.

Formation of 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.

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