

Research Article EFFECTIVENESS OF EXTENSION SERVICES RECEIVED BY REDGRAM GROWERS IN NORTH-EASTERN KARNATAKA

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Abstract: Redgram is one of the major pulse crops of the tropics and sub-tropics region, grown in approximately 50 countries in Asia, Africa and the Americas. In India, redgram mainly grown in many states like Maharashtra, Madhya Pradesh, Karnataka, Andra Pradesh, Rajasthan and Uttar Pradesh and it occupies 3.89 million hectares of area with the about 3.30 million tonnes of production, having yield of 849 kg per hectare on an average. In Karnataka, redgram accounts an area of 0.82 million hectares with the 0.61 million tonnes of production, having an average productivity of 733 kg per ha. The research study conducted mainly in 3 districts viz, Bidar, Kalaburgi and Yadgir districts of North Eastern region of Karnataka during the year 2016-18 to know the effectiveness of extension services received by redgram growers. The data were collected from the randomly selected 180 redgram growers through personal interview method using structured pre-tested interview schedule. The results of the study reveal that 43.89 percent of the redgram growers were having medium level of effectiveness *i.e.*, moderately effective followed by high effectiveness (33.89 %) and 22.22 percent were having less effectiveness of extension services which is provided by the extension agency to redgram growers.

Keywords: Effectiveness, Extension services, Redgram, Extension agency, Pulse crops, Production

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Introduction

India stands first in area and production under pulses. It contributes 25 and 27 percent to the worlds' pulse production and consumption, respectively. The current status of pulse production in terms of area is 23.47 million hectare with the production of 18.34 million tonnes and productivity being 781 kg/ ha. The present demand for pulses in the country is 17 million tonnes whereas the production is less than the requirement *i.e.*, 15.19 million tonnes. In India the states like, Madhya Pradesh followed Maharashtra, Uttar Pradesh, Andhra Pradesh, Karnataka and Rajasthan are the major pulse growing states. The contribution of above-mentioned states to the total pulse production of the country is 80 percent [1]. Pigeonpea [Cajanus cajan (L.) Millsp., Family- Fabaceae], stands in the list of the major pulse crops of the tropics and sub-tropics, this has grown in approximately 50 countries in Asia, Africa and Americas, mostly as an intercrop with cereals. It is commonly known as pigeonpea, redgram, tur, arhar, tuvarica, congobean, thogari or gandul in India. Redgram stood 6th (sixth) rank in area and production in comparison to other pulses such as beans, peas, and chickpeas. In India, Pigeonpea or redgram mainly grown in many states like Maharashtra, Madhya Pradesh, Karnataka, Andra Pradesh, Rajasthan and Uttar Pradesh and it occupies 3.89 million hectares of area with the about 3.30 million tonnes of production, having yield of 849 kg per hectare on an average [1]. In Karnataka, redoram accounts an area of 0.82 million hectares with the 0.61 million tonnes of production, having an average productivity of 733 kg per ha. It is largely cultivated in northern parts of Karnataka like, Kalaburgi (Gulbarga), Vijayapura (Bijapur), Bidar and Yadgir districts. Thus, North-East Karnataka region is called as "Pulse bowl of Karnataka". Adoption of recommended technologies and proper management techniques helps in enhancing the productivity of redgram. The farmer expects more income from their farm, which may be in the terms of yield or income which is obtained by selling produced quantity in the market, is needed for meeting the needs and necessity of the family and household.

Therefore, agricultural extension is the key mechanism for the growth of agriculture both in terms of technology transfer and overall development such as capacity building, skill development and risk bearing ability. Agricultural extension is considered as the repository of agricultural knowledge and practical application of scientific research which helps in educating farmers. The field of extension has grown up to the larger extent and as it encompasses various activities which is being organized and implemented by the professionals of various disciplines as the stakeholders to benefit farmers. Agricultural extension provides situational and need based information and impart specific skills to rural people who are involved in conventional agriculture in non-formal situation. It is a mechanism for bringing behavioural transformation and technological adoption, and it plays the role of transferring technology to the farming community and conveys feedback and farmers problems to the system of research. Farmers can easily understand by seeing the result of innovative technology in the field and also by conducting demonstration. The innovative technological advancements and research findings utilized by farmers effectively, through various activities of extension. Thus, extension will help to transferring knowledge to farmers, advising and educating farmers in their decision making, problem solving, enabling farmers to clarify their objectives and goals, to identify their role in agriculture and stimulating desirable agricultural developments. Agricultural extension services providing more emphases on innovative practices and different methods. Government also focusing on extension services and activities so that easily farmer reaches the goal and thereby gets maximum income and benefit with less investment. When the farmer satisfied with the services provided by government, line departments, NGOs', private agency then only it is worthy and effective for farmers to get more returns. Public, private and non-profit organizations are involved in providing agricultural extension services to farming community in India. The major Public agricultural extension service providers are, line departments of the state government like Department of Agriculture, Horticulture, Animal husbandry etc.

first line extension system of Directorate of Extension and other wings of State Agricultural Universities (SAUs'), various research units of ICAR, commodity boards like Rubber Board and Coffee Board. Private extension service providers are Co-operatives and Farmers Associations and Farmers Producers' Cooperatives besides these, private companies, which provide inputs like seeds, fertilizers, chemicals and farm machinery, Agro processing units, private consultants, Agri-Clinics and Agri-Business Centers (AC&ABC), input dealers and print media. Non-Governmental Organizations includes (NGOs) working in the area of agriculture and rural development and others including autonomous institutions in crop specific areas, banks through the internet facility and officials. Department of Agriculture, Karnataka (KSDA) is the responsible agency for conducting activities of extension and dissemination of technology in Karnataka. Government of Karnataka started Raith Samparka Kendra (RSK) in the year 2000 at Hobli level (block level) to provide extension services to farmers. RSK's working at Hobli level as the grass root level organizations for transfer of modern and innovative agricultural technologies. Currently there are 745 RSKs working across the state and are functioning under the administrative control of Zilla Panchayat. Besides Department of Agriculture, State Agricultural Universities (SAUs'), NGOs', private input supply companies, agribusiness and agricultural consultancies, commodity boards etc., also play crucial role in providing effective services of extension to the farming community in the state.

Methods and Materials

The study conducted to know the effectiveness of extension services received by redgram growers. The research study conducted in North Eastern region of Karnataka mainly in 3 districts viz, Bidar, Kalaburgi and Yadgir during the year 2016-18. These districts were purposively selected as these ranks first, second and third in area and production of redgram. In each district two taluks were selected and from each taluk two village were selected for the study. Thus, 30 respondents were selected. Thus, constituting total sample size is 180. Ex-post fact research design suitable for the study and employed. Personal interview technique was used for data collection. Thereafter data were tabulated, analysed and interpreted in the light of objectives of the study.

Results and Discussion

Effectiveness of extension services provided to the redgram growers

Effectiveness of extension services is the degree to which redgram growers gain knowledge, adopt the improved practices and their satisfaction to extension services provided by the extension agency. The results on the same were indicated under different sub-heads and the following tables.

Overall effectiveness of extension services

A perusal of data in [Table-1] reveals that 43.89 percent of the redgram growers were having medium level of effectiveness *i.e.*, moderately effective, 33.89 percent of them having high effectiveness and 22.22 percent were having less effectiveness of extension services which is provided by the extension agency to redgram growers. As effectiveness depends on knowledge and adoption of the practices, the results indicate that most of the respondents were having good knowledge and high level of adoption of the correct practices of redgram cultivation. Respondents having middle to higher education, medium land holding and medium social participation expressed that the effectiveness of agricultural extension services was found somewhat higher level. This brings out that the progressive farmer strategy is prevalent in the extension service of the redgram cultivation area. These findings are in line with the findings of [2-4].

Table-1 Overall effectiveness of extension service, (n=	180)
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Particulars	Categories	Criteria	Resp	ondents
			No.	%
Effectiveness	Less effective	<19.83	40	22.22
Mean= 21.77	Moderately effective	19.83-23.72	79	43.89
SD = 3.89	Highly effective	>23.72	61	33.89

Dimension wise effectiveness of extension services

A perusal of [Table-2] indicated the classification of redgram growers based on

different dimensions of effectiveness of extension service, 42.78 percent of the redgram growers were having high level of knowledge, followed by medium (35.56 %) and low (21.66 %). Majority of them were middle aged, educated upto high school. Another reason for high knowledge could be that, majority of respondents were belonged to medium level of farming experience followed by high farming experience. It is a fact that, as the experience increases, corresponding of knowledge level also increases. Respondents with more farming experience would able to know the strengths and weaknesses of the recommended practices of redgram cultivation. In case of adoption, 40.56 percent were having medium level of adoption, 31.66 percent were coming under the high level and 27.78 percent having low level of adoption. The reason might be that, majority of the farmers had middle school level education, medium land holding, high level of achievement motivation, high innovativeness and medium level market orientation. Hence, all these factors might have influenced them to fall under medium adoption category. Further, as the land holding and income increases naturally and they prove towards economical returns. Good education level and farming experience might have increased their knowledge level and hence fell in medium adoption category so as to gain more income. With respect to client satisfaction, 40.56 percent of them were having medium level of satisfaction, 22.78 percent having low satisfaction and 36.66 percent having high level of satisfaction. The redgram growers having middle to higher education level so that they might have supplementary knowledge about cultivation practices of redgram, medium land holding, extension contact, participate in mass media and medium social participation expressed that the effectiveness of agricultural extension services was falls under medium level category. These findings are in line with the findings of [2-5].



Fig-1 Overall effectiveness of extension service

Table-2 Dimension wise effectiveness of extension services, (n=180)

S	Aspects	Categories	Criteria	Respondents			
				No.	%		
1	Knowledge	Low	<19.83	39	21.66		
	Mean = 21.77	77 Medium 19.83-23.72		64	35.56		
	SD = 3.89	High	>23.72	77	42.78		
2	Adoption	Low	<23.65	50	27.78		
	Mean= 26.46	Medium	23.65-29.26	73	40.56		
	SD = 5.61	High	>29.26	57	31.66		
3	Client satisfaction	Low	<67.72	41	22.78		
	Mean= 72.63	Medium	67.72-77.55	73	40.56		
	SD = 9.83	Hiah	>77.55	66	36.66		

Knowledge level of redgram growers

Data on knowledge of redgram growers were given in [Table-3] and it could be inferred that cent percent of them were having correct knowledge on cultivation practices like summer ploughing, ideal month for sowing, nearly ninety nine percent were having correct knowledge on recommended variety of redgram and having knowledge on important pest in redgram. In case of practices like after how many days the intercultural operations were done 96.11 percent of the redgram growers had correct knowledge, 95.56 percent of them had correct knowledge each on practices like how many times the intercultural operation and crops grown as intercrop with redgram. The findings were in conformity with the findings of [2-6].

International Journal of Agriculture Sciences ISSN: 0975-3710&E-ISSN: 0975-9107, Volume 11, Issue 12, 2019 Table-3 Knowledge level of redgram growers about redgram cultivation practices, n=180)

Drastiana	E	0/
Practices	F	%
Summer ploughing (Increase the yield)	180	100.00
Recommended variety of redgram (Asha, Maruti ,TS-3 and TS-3R)	178	98.89
High yielding variety in red gram (TS-3R)	147	81.70
Short duration variety (ICPL-87)	156	86.67
Ideal month for sowing red gram (15th June)	180	100.00
Seed rate required per acre in redgram (4.4 kg/acre)	134	74.44
After how many days the transplanting will be done (25-30 days)	76	42.22
Purpose of transplanting (Increase the yield)	98	54.44
Ideal spacing (90 x 30cm)	156	86.67
Quantity of FYM required (2.4 tonn)	131	72.78
The bio-fertilizers used for seed treatment (Rhizobium, PGPR and PSB) $% \left({{{\left({{\left({{\left({{\left({{\left({{\left({{\left$	143	79.44
Recommended quantity of bio-fertilizer (200g/acre)	102	56.67
Recommended micronutrient (ZnSo4)	123	68.33
Quantity of ZnSo4 applied (6kg per acre)	101	56.11
Recommended chemical fertilizers (NPK)	159	88.33
Recommended NPK basal dose of fertilizers (25:50:20)	122	67.78
Crops grown as intercrop with redgram (Jowar, Sesame, Green gram and Blackgram)	172	95.56
Recommended weedicide (Pendimethlion and Alachlor)	147	81.67
Recommended quantity of weedicide (2.2ml/ltr water)	114	63.33
After how many days the inter cultural operations (15-20 DAS)	173	96.11
How many times the inter cultural operation (2-3 times)	172	95.56
Special practices followed in redgram (Nipping)	130	72.22
Important pest in redgram crop (Pod Borer)	178	98.89
Important recommended pesticide for management of pod borer (Prophenophos and DDVP)	148	82.22
Important diseases of redgram (Wilt)	160	88.89
Important recommended fungicide for management of wilt (Capton and Thiram)	127	70.56
Yield from one acre of redgram (4.4qtl/acre)	159	88.33
The IPM practices know and you have followed	53	29.44

More than eighty percent of the redgram growers had correct knowledge on cultivation practices like important diseases of redgram (88.89 %), yield from one acre of redgram (88.33 %), recommended chemical fertilizer (88.33 %), short duration variety (86.67 %), ideal spacing (86.67 %), important recommended pesticide for management of pod borer(82.22 %), high yielding variety in redgram (81.70 %), recommended weedicide (81.67 %), the bio-fertilizers used for seed treatment (79.44 %), seed rate required per acre in redgram (74.44 %), guantity of FYM required (72.78 %), special practices followed in redgram (72.22 %), important recommended fungicide for management of wilt (70.56 %), recommended micro nutrient (68.33%), recommended basal dose of fertilizers (67.78%), recommended quantity of bio-fertilizer (56.67%), quantity of ZnSo4 (56.11 %), purpose of transplanting (54.44 %), after how many days the transplanting will be done (42.22 %) and the IPM practices you have followed (29.44 %). This trend of results might be due to the fact that, farmers might have acquired knowledge about recommended cultivation practices since the respondents had medium farming experience, better education, large land holdings, participation in extension activities and better extension contact and high income. Another reason might be more exposure to various training programmes, awareness programmes, demonstration, more exposure to mass media, high level of social participation, regular contact with extension agency and private fertilizer company representatives, etc. All these factors might have influenced the respondents to acquire more knowledge. It is quite natural that, if the individual is having higher education, high land, more farming experience with higher income, naturally one would like to have more knowledge about new technologies and would like to earn more profit. Another reason might be that the redgram is an important crop grown by farmers in this region. The attack of pests and diseases is also said to be more in redgram. Hence, farmers have better knowledge about redgram cultivation practices, how to overcome the pests and diseases to problem for getting higher yields. Reasons for the lack of knowledge about the transplanting, pesticide and fungicide dosage might be illiteracy among farmers or low level education, lack of technical know how about transplanting, pesticides, insufficient knowledge about recommended dosage of pesticides, lack of skill involved in spraying of pesticides and transplanting stage might be the reason on the part of farmers. These findings are in line with the findings of [2,3, 7-9].

Adoption level of redgram growers

A cursory look at [Table-4] shows that more than eighty percent of the redgram growers fully adopted the practices like varieties of redgram grown (95.56 %), ideal month for sowing redgram (91.11 %), once in how many days the inter culture operation will be done (89.44 %), recommended chemical fertilizers (81.11 %). Seventy six percent of them fully adopted how many times the intercultural operations will be done (76.11 %), followed by high yielding variety in redgram (75.00 %) seed rate required per acre in redgram (72.78 %), short duration variety (68.89 %), important recommended pesticide for management of pod borer (60.00 %). Fifty seven percent of them partially adopted quantity of FYM (farm yard manure) required, 47.22 percent of them adopted ideal spacing. Thirty one percent of them not adopted recommended micronutrient and adequate quantity of Znso4 applied each. Only three percent of them not adopted recommended varieties of redgram grown. The adoption of any technology and recommended cultivation practices of redgram in particular depends on various factors such as awareness about red gram cultivation practices, extent of change agencies efforts, complexity of practices, timely availability of inputs, characteristics of farmers etc. However, it is true that all the recommended practices will not be adapted to same degree by all the members in a given social system. The medium level of adoption is due to their medium level of exposure to mass media and information seeking behaviour, social participation, regular contact with extension agency and private fertilizer company representatives, etc. which made possible the higher level of adoption. There is a need for conducting training programmes for farmers in every year just before the season starts on various redgram cultivation practices. The extension workers should be instructed to conduct demonstrations and trials at farmers' fields to show them the benefits of adopting various redgram cultivation practices and new technology [2,3,9].

Client satisfaction on agricultural extension services

The data in [Table-5] indicated that 76.11 percent of redgram growers agreed that the services of agricultural department are rewarding and needs to be continued, 76.11 percent of them agreed agricultural extension personnel found to have regular contact with fellow farmers, 74.44 percent agreed that Agricultural extension services helped to a great extent in improving the standard of living of the fellow farmers and 70.56 percent agreed that mass media channels are useful to solve farmers' problems. The probable reason might be that, the farmers having good contact with different extension agency and line department so that they will get information on time. Extension personnel also visit frequently to their villages which leads to better contact with farmers and farmers can consult with them [10].

Conclusion

Based on the above study it can be inferred that 43.89 percent of the redgram growers were having medium level of effectiveness *i.e.*, moderately effective, 33.89 percent of them having high effectiveness and 22.22 percent were having less effectiveness of extension services which is provided by the extension agency to redgram growers. In the classification of redgram growers based on different dimensions of effectiveness of extension service. With respect to knowledge that, 42.78 percent of the redgram growers were having high level of knowledge, followed by medium (35.56 %) and low (21.66 %). In case of adoption, 40.56 percent were having medium level of adoption, 31.66 percent were coming under the high level and 27.78 percent having low level of adoption. With respect to client satisfaction, 40.56 percent of them were having medium level of satisfaction, 22.78 percent having low satisfaction and 36.66 percent having high level of satisfaction. Farmers having good contact with different extension agency and line department so that they will get information on time. Extension personnel also visit frequently to their villages which leads to better contact with farmers and farmers can consult with them which leads to fall in medium level of effectiveness on extension services.

Effectiveness of Extension Services Received by Redgram Growers in North-Eastern Karnataka

S	Practices	Full adopted		ted Partially Adopted		Not adopted	
		F	%	F	%	F	%
1	Varieties of redgram you have grown (Asha, Maruti, TS-3 and TS-3R)	172	95.56	2	1.11	6	3.33
2	High yielding variety in redgram (TS-3R)	135	75.00	13	7.22	32	17.78
3	Short duration variety (ICPL-87)	124	68.89	13	7.22	43	23.89
4	Ideal month for sowing redgram (15th June)	164	91.11	16	8.89	0	0.00
5	Seed rate required per acre in redgram (4.4 kg/acre)	131	72.78	49	27.22	0	0.00
6	After how many days the transplanting will be done (25-30 days)	4	2.22	2	1.11	174	96.67
7	Ideal spacing (90 x 30cm)	95	52.78	85	47.22	0	0.00
8	Quantity of FYM required (2.4 tonn)	22	12.22	103	57.22	55	30.56
9	The biofertilizers used for seed treatment (Rhizobium, PGPR and PSB)	74	41.11	70	38.89	36	20.00
10	Recommended quantity of biofertilizer (200g/acre)	69	38.33	75	41.67	36	20.00
11	Once in how many days the inter culture operation (15-20 days)	161	89.44	14	7.78	5	2.78
12	How many times the inter cultural operations (2-3 times)	137	76.11	38	21.11	5	2.78
13	Recommended micronutrient (ZnSo4)	100	55.56	23	12.78	57	31.67
14	Quantity of ZnSo4 applied (6kg/ acre)	80	4.44	43	23.89	57	31.67
15	Recommended chemical fertilizers (NPK)	146	81.11	16	8.89	18	10.00
16	Recommended NPK basal dose of fertilizers (25:50:20)	62	34.44	60	33.33	58	32.22
17	Crops grown as intercrop with redgram (Jowar, Sesame, Greengram and Blackgram)	75	41.67	27	15.00	78	43.33
18	Recommended weedicide (Pendimethlion and Alachlor)	41	22.78	23	12.78	116	64.11
19	Recommended quantity of weedicide (2.2ml/ltr water)	19	10.56	41	22.78	120	66.67
20	Special practices followed in redgram (Nipping)	3	1.67	3	1.67	174	96.67
21	Important recommended pesticide for management of pod borer (Prophenophos and DDVP)	108	60.00	24	13.33	60	26.67
22	Important recommended fungicide for management of wilt (Capton and Thiram)	63	35.00	25	13.89	92	51.11
23	The IPM practices you have followed	4	2.22	19	10.56	157	87.22

Table-4 Adoption level of redgram growers, (n=180)

S _	Statements	SDA		DA		NADA		A		SA	
		No.	%	No.	%	No.	%	No.	%	No.	%
1	Agricultural extension workers are actively engaged in dissemination of information related to Agriculture and Allied field	18	10.00	17	9.44	17	9.44	123	68.33	5	2.78
2	Technological information provided by agricultural extension personnel are relevant and consistent with farmers agro-ecological conditions	20	11.11	19	10.56	20	11.11	119	66.11	2	1.11
3	Mass media channels are useful to solve farmers' problems	4	2.22	17	9.44	18	10.00	127	70.56	14	7.78
4	Agricultural extension personnel found to have regular contact with fellow farmers	5	2.78	15	8.33	11	6.11	137	76.11	12	6.67
5	Group discussion meeting conducted by agricultural extension workers were effective in sharing needed information and solving field problems	5	2.78	16	8.89	20	11.11	125	69.44	14	7.78
6	Agricultural extension personnel found to have direct interaction between researchers and farmers at field level	5	2.78	14	7.78	21	11.67	119	66.11	21	11.67
7	Agricultural extension personnel provide needed information well in time	18	10.00	17	9.44	18	10.00	122	67.78	5	2.78
8	The input supplied through Agriculture department are high quality	3	1.67	19	10.55	26	14.44	115	63.89	17	9.44
9	The input supplied through Agriculture department are highly subsidized	2	1.11	26	14.44	27	15.00	118	65.56	7	3.89
10	Agricultural inputs related information was conveyed to farmers	2	1.11	22	12.22	29	16.11	120	66.67	7	3.89
11	Training programs organized by Agricultural extension personnel helped in changing knowledge, attitude and skills of farmers	5	2.78	22	12.22	29	16.11	108	60.00	16	8.89
12	Agricultural extension personnel at farmers field were convincing to the fellow farmers	5	2.78	23	12.78	26	14.44	110	61.11	16	8.89
13	The Agricultural extension personnel are good trainers in subject matter as well as in motivation	5	2.78	16	8.89	27	15.00	116	64.44	16	8.89
14	The Agricultural extension personnel are readily available and accessible whenever the farmers seek their help	5	2.78	16	8.89	27	15.00	116	64.44	16	8.89
15	The Agricultural extension personnel are competent in solving farmers field problems and advice advisory services	18	10.00	17	9.44	18	10.00	122	67.78	5	2.78
16	Agricultural extension personnel are corrupt and do all sorts of malpractices (-)	6	3.33	13	7.22	18	10.00	125	69.44	15	8.33
17	Agricultural extension personnel have genuine interest in working for resource poor farmers	5	2.78	23	12.78	26	14.44	118	65.56	8	4.44
18	Agricultural extension serves as a channel of information helped in adopting the latest technologies and increased the production	18	10.00	15	8.33	24	13.33	114	63.33	9	5.00
19	Agricultural extension services helped to a great extent in improving the standard of living of the fellow farmers	0	0.00	10	5.56	25	13.89	134	74.44	11	6.11
20	The services of agricultural department are rewarding and needs to be continued	2	1 1 1	15	8 33	16	8 89	137	76 11	10	5 56

SA-Strongly Agree; A-Agree; NADA-Neither Agree Nor Dis Agree; DA-Dis Agree; SDA-Strongly Disagree

The findings of the present study provide the empirical feedback to line departments, SAUs and various organization working in agricultural and allied departments to strengthen the research-extension-farmer linkage by providing credible and timely information to the farming community. The ICAR has started a programme of organizing front line demonstrations on pulses in order to motivate farmers to increase the area under cultivation there by enhancing production. Extension service should be play important role to disseminate important and improved technologies mainly related to crop management, insect, pest and diseases management with emphasis on skill to farmers. Result demonstrations and various farmer programmes on pulses cultivation should be organized by the

extension personnel's to increase the income of the farmers. The demonstration plays a very important role to disseminate recommended technologies because it shows the potential of technologies resulting in an increase in yield at farmers' level.

Application of research: Extension services are main source for the redgram growers to get information and input on time and also extension services very much effective for the farmers to get maximum yield and increase the income.

Research Category: Agricultural Extension

Abbreviations: SAUs- State Agricultural Universities, NGOs- Non-Governmental Organizations, ICAR-Indian Council of Agricultural Research.

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Research Guide or Chairperson of research: Dr K. Venkataranga Naika University: University of Agricultural Sciences, GKVK, Bengaluru, 560065 Research project name: PhD Thesis

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: 3 districts Bidar, Kalaburagi and Yadgir districts of North Eastern Karnataka

Cultivar / Variety / Breed name: Pigeonpea [Cajanus cajan (L.) Millsp.

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors. Ethical Committee Approval Number: Nil

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