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Adoption of climate smart technologies among redgram growers in Magadi and Sira Taluks of Ramanagara and Tumkur districts of Southern Karnataka

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Abstract
Redgram is an important legume crop of rain fed agriculture in countries like India. Number of methods and practices are being adopted to address climate change challenges by altering cropping patterns, planting dates and farm management techniques. Climate smart technologies are operationally defined as those technologies that enhance agriculture production and productivity through judicious use of resources that improves the sustainability of redgram cultivation through adoption of modern production and risk management technologies under changing climate. The present study was carried out in Magadi taluk of Ramanagara district and Sira taluk of Tumkur district in Karnataka state during 2020 – 21 to assess the extent of adoption of climate smart technologies among redgram growers. A total of 120 redgram growers were interviewed, 60 from each selected taluk of respective districts for the purpose. The results revealed that 40.00 percent of redgram growers possess medium level of adoption followed by high (34.17) and low (25.83) level of adoption respectively. Great majority of redgram growers (95.83%) had adopted the varieties recommended by the UASB, among the varieties majority of redgram growers (78.33%) adopted BRG 1 Variety. Cent percent of redgram growers (100%) had not adopted climate smart technologies like Transplanting, majority of the redgram growers (93.33%) had not adopted 1% KCL / litre of water. Less than half of redgram grower (48.33%) had partially adopted intercropping of groundnut with redgram in recommended proportion and great number of redgram grower (39.17%) had partially adopted bird perches.

Keywords: Adoption, climate smart technologies, redgram

Introduction
Agriculture zone is one among the most vulnerable zone which is at risk due to the influence from the climate change because entire agricultural productivity is intuitive to variations in climatic conditions and agricultural production is always associated with change in the weather conditions. The Inter-governmental Panel on Climate change (IPCC) defined climate as the average weather, or the statistical illumination in terms of mean and variability of relevant aggregates like temperature, solar radiation, rainfall etc., above some duration ranging from months to millions of years. Change in climate is actually a long-term change in the average weather status that have come to define earth's local, regional and global climates i.e., modification of average weather conditions around long term conditions. The influence of changes in climate are global, but countries like India is at high risk because majority of the population is rested on Agriculture. Since agriculture contributes to around 18 percent of India's GDP, 4.50 to 9.00 percent negative influence on yield implicit amount of change in climate to be around up to 1.50 percent of GDP per annum (Venkateswarlu *et al.,* 2013) [4].
Redgram is an important legume crop of rain fed agriculture in countries like India. Number of methods and practices are being adopted to address climate change challenges by altering cropping patterns, planting dates and farm management techniques. Disease resistant varieties of redgram are being developed and distributed by government organisations. In addition to these, most of the farmers are integrated vegetables and animals with redgram cultivation. The residues and waste from each of these components are composted and used on the land, thereby reducing the need for external inputs. The development of advanced model techniques, mapping the effect of climate change on redgram growing regions and providing crop insurance are other examples of managing risks and reducing vulnerability. In India, Maharashtra having maximum area and production under redgram cultivation with 15.33 lakh ha and 13.89 lakh tonnes followed by Karnataka with an area around 12.14 lakh ha and production for around 8.62 lakh tonnes.

Karnataka is followed by Madhya Pradesh with an area of 6.90 lakh ha and production of 7.82 lakh tonnes that is followed by Gujarat with an area of 3.34 lakh ha and production of 3.69 lakh tonnes and Gujarat is followed by Uttar Pradesh with an area of 3.38 lakh ha and production of 3.36 lakh tonnes (Anonymous, 2017).

In Karnataka, Gulbarga having maximum area and production under redgram cultivation with 6,13,760 ha and 5,69,078 tonnes followed by Vijayapura with an area around 3,88,932 ha and production for around 3,30,320 tonnes. Vijayapura is followed by Yadgiri with an area of 1,10,119 ha and production of 74,798 tonnes that is followed by Raichur with an area of 1,02,883 ha and production of 5,69,078 tonnes and Raichur is followed by Bidar with an area of 77,019 ha and production of 34,828 tonnes (Anonymous, 2018). Ramanagara Anonymous, 2018).

Tumkur district is one of the agricultural productive district of Southern Karnataka with annual rainfall of 900mm. The district agriculture is grouped under agro climatic zone 4 which falls under Central dry zone. Total geographical area of Tumkur district is 10597sq.km out of which 4.80 lakh hectares are cropped area and supports 10507 ha for redgram cultivation out of its 4.80 lakh ha cropped area. Out of 10 taluks of Tumkur district, Sira taluk supports 2598 ha for redgram cultivation (Anomymous, 2018). Now a days farmers of Ramanagara and Tumkur district are facing the district is one of the agricultural productive district of Southern Karnataka with annual rainfall of 931.58 mm. Cauvery, Arkavathi and Kanva are the three rivers flowing in the district. The district agriculture is grouped under agro-climatic zone 5 which falls under Eastern dry zone. Total geographical area of Ramanagara district is 3516 sq. km out of which 1,62,322 ha are cropped area and supports 3468 ha for redgram cultivation out of its 1,62,322 ha cropped area. Out of 4 taluks of Ramanagara district, Magadi taluk supports 1287 ha for redgram cultivation acute shortage of water and the farmers left the redgram fields fallow. Even though water saving and climate smart technologies are available, the countrymen is not adopting these technologies. Many eco-friendly and sustainable practices are being developed by the scientists. Adoption is a decision to make an innovation as the best course of action available. In the current study adoption is operationally defined as the Extent of actual use of Climate smart technologies by the redgram growers.

Methodology

The research design employed for the study was *ex-post-facto* design, since the phenomenon has already occurred. *Ex post facto* study or post event investigation is a category of research design in which the researcher begins after the event has occurred without the intervention of the researcher. Here the researcher does not have direct control over independent variables because their manifestations have already occurred.

Locale of the research study

Ramanagara district has 4 taluks out of which Magadi taluk has been selected and Tumkur district has 10 taluks out of which sira taluk was selected. The total geographical area of the magadi taluk is 801sq.km out of which 1287 ha comes under redgram cultivation. The total geographical area of the sira taluk is 1556 sq.km out of which 2598 ha comes under red gram cultivation.

Brief description of the study area

Ramanagara district is one of the agricultural productive district of Southern Karnataka with annual rainfall of 931.58 mm. Cauvery, Arkavathi and Kanva are the three rivers flowing in the district. The district agriculture is grouped under agro-climatic zone 5 which falls under Eastern dry zone. Total geographical area of Ramanagara district is 3516 sq. km out of which 1,62,322 ha are cropped area and supports 3468 ha for redgram cultivation out of its 1,62,322 ha cropped area. Out of 4 taluks of Ramanagara district, Magadi taluk supports 1287 ha for redgram cultivation (Anonymous, 2018).

Tumkur district is one of the agricultural productive district of Southern Karnataka with annual rainfall of 900 mm. The district agriculture is grouped under agro climatic zone 4 which falls under Central dry zone. Total geographical area of Tumkur district is 10597 sq.km out of which 4.80 lakh hectares are cropped area and supports 10507 ha for redgram cultivation out of its 4.80 lakh ha cropped area. Out of 10 taluks of Tumkur district, Sira taluk supports 2598 ha for redgram cultivation (Anomymous, 2018).

Selection of respondents

Agriculture officers (AAOs) of Karnataka state department of agriculture, Scientists of KVK were consulted in selection of villages. From each of the selected taluks six villages were selected by applying simple random sampling technique. From each of these selected villages 10 respondents were taken for the study and thus, 120 farmers constituted the sample for study.

Table 1: The details of districts, taluks, villages and respondents selected for the study:

District	Taluk Assistant	Village	Respondent
1. Ramanagara	Magadi	Harohalli	10
		Gattipura	10
		Gejjagaragupe	10
		Kalya	10
		Chittanahalli	10
		Kalarikaval	10
2. Tumkuru	Sira	Chikkaagrahara	10
		Battiganahalli	10
		Hanumanahalli	10
		Rangapura	10
		Hemdore	10
		Malekunte	10
Total			120

The procedure suggested by Sengupta (1967) with slight modification for calculation of adoption quotient was utilized to measure the general adoption level of the respondents. Accordingly, the following formula was used to calculate the overall adoption level.

$$\text{Adoption quotient} = \frac{\text{Actual score obtained by the respondent}}{\text{Maximum Adoption score attainable}} \text{X } 100$$

The partial adoption technique suggested by Supe (1969) [2] was followed with necessary modifications for scoring the cultivation practices and it is as below:

Items	Scores
Full adoption	2
Partial adoption	1
No adoption	0

Considering all the important climate smart technologies in redgram cultivation, twenty five recommended climate smart technologies were listed based on the suggestions of the specialists. The correct answers to the listed items were obtained with the help of climate smart technologies. Thus, the maximum score one could get was 50 and the minimum was zero.

Results and Discussion

Overall adoption of climate smart technologies by redgram growers.

A close look at Table 2 shows the overall adoption of climate smart technologies by small and big farm redgram growers. More than two fifth of small farmers had medium (41.67%) to high (31.67%) level of adoption, followed by low level of adoption (26.67%). On the other hand, in case of big farmers, majority of respondents had medium (38.33%) to high (36.67%) level of adoption followed by low level of adoption (25.00%). When the pooled sample was considered 40.00 percent, 34.17 percent and 25.83 percent of redgram growers possessed medium, high and low level of adoption respectively, medium level of adoption (41.67%) was found in case of small farmers compared to big farmers (38.33%). (Krishnamurthy, 2015) [1]

Table 2: Overall adoption of climate smart technologies by redgram growers.

Adoption level	Small farm redgram growers (n_1=60)		Big farm redgram growers (n_2=60)		Total (n=120)	
	F	%	F	%	F	%
Low (<28.60)	16	26.67	15	25.00	31	25.83
Medium (28.60-38.57)	25	41.67	23	38.33	48	40.00
High (>38.57)	19	31.67	22	36.67	41	34.17
Mean 33.58						
SD 09.96						

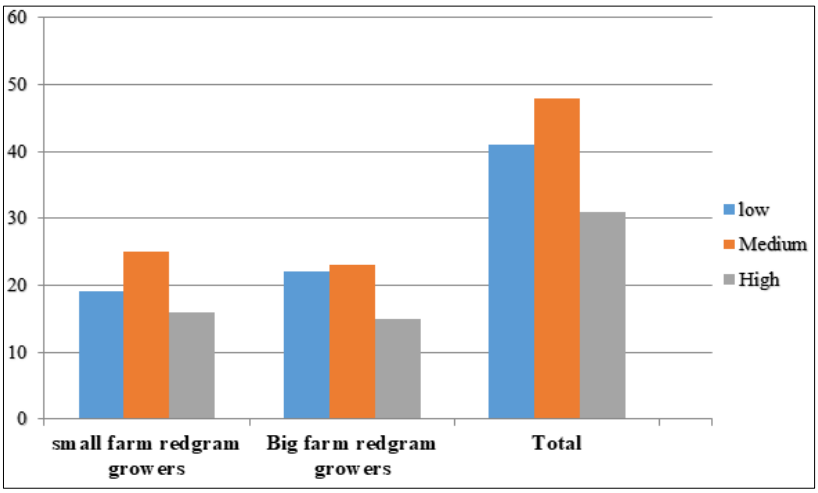

Fig 1: Overall adoption of climate smart technologies by redgram growers

Extent of adoption of climate smart technologies by redgram grower

The data in Table 3 shows that, great majority of redgram growers (95.83%) had adopted the varieties recommended by the UASB, among the varieties majority of redgram growers (78.33%) adopted BRG 1 Variety. Good number of redgram growers (75.00%) had adopted earthing up on the recommended time period and good number of redgram grower (66.67%) had adopted nipping on the recommended time period. The possible reason for the above trend may be that UASB recommended varieties are readily available in KVK's and RSK's at a subsidized rate in the area. Among the UASB varieties, most of the farmers adopted BRG 1 because of its good market value. Further, the districts under the study falls under the rain fed condition, majority of farmers had taken up earthing up to conserve water. A great number of growers adopted nipping to get lateral branches, flowers and to get more yield. Apart from this these technologies are simple, most important and crucial in production. Hence, majority of farmers adopted these technologies. (Krishnamurthy, 2015) [1]

Cent percent of redgram growers (100%) had not adopted climate smart technologies like Transplanting. Majority of the redgram farmers (93.33%) had not adopted 1% KCL / litre of water. Great number of growers not adopted the pulse magic spray (89.17%). A great number of redgram growers (80.00%) had not adopted foliar spray of 19 all and three fourth of the redgram growers (69.17%) had not adopted BRG 3 variety and majority of redgram growers (52.50%) had not adopted seed treatment with bio agent (*Trichoderma viridae*). Farmers not adopted transplanting may be due to the fact the growers were not well aware about the importance of transplanting during late monsoon season and majority of the farmers not adopted the application of 1 percent KCL / litre of water may be due to the fact that the farmers were not aware of the importance of application of 1 percent KCL / litre of water during water stress condition and Due to the less availability of pulse magic spray in the market, farmers are not aware about the importance of pulse magic spray and majority of growers not adopted foliar spray of 19:19:19 because farmers are not ready to invest more on plant protection chemicals which involve more risk. Due to lack of knowledge among the majority of the growers led to the non-adoption of the BRG 3 variety. Majority of farmers not adopted seed treatment with bio agent (Trichoderma viridae) because of lack of knowledge among growers and also effect

of bio agent can never be seen immediately which hinders the adoption of bioagents among growers. Apart from this due to lack of awareness, training, guidance on how to use these technologies to the farmers by the extension agency and agricultural officers also accounts for non-adoption (Suresh, 2009) [3].

Less than half of redgram grower (48.33%) had partially adopted intercropping of ground nut with redgram in recommended proportion and majority of redgram grower (35.80%) had partially adopted BRG 5 variety and a great number of redgram grower (39.17%) had partially adopted bird perches. A probable reason for partially adoption of intercropping of groundnut with redgram in recommended proportion may be due to the fact that growers don't have correct knowledge about the proportion to be maintained as a result of which they maintained either excess or less than the recommended proportion. Majority of redgram had partially adopted the variety BRG 5 due to lack of awareness, lack of conviction and lack of guidance from the agricultural institutions and great number of growers partially adopted bird perches due to the lack of knowledge among growers and growers also expressed it may increase their cost of cultivation (Krishnamurthy, 2015) [1].

Table 3: Extent of adoption of climate smart technologies by redgram growers.

Sl. No.	Recommended Technologies	Red gram growers (n=120)					
		Full adoption		Partial adoption		No adoption	
		f	%	F	%	F	%
	Varieties						
1.	Do you follow recommended varieties of UASB (BRG 1,BRG2, BRG3, BRG5)	115	95.83	05	04.17	00	00.00
2.	**Do you use the following varieties**						
A.	BRG 1	94	78.33	19	15.83	07	05.84
B.	BRG 2	08	06.60	39	32.50	73	60.90
3.	Do you follow variety resistant to wilt (BRG 5)	59	49.16	43	35.80	18	15.00
4.	Do you follow variety resistant to wilt and yellow mosaic virus (BRG 3)	30	25.00	07	05.83	83	69.17
	Spacing						
5.	Do you follow recommended spacing for early sowing (3 to 4 ft * 0.5 ft)	65	54.17	35	29.17	20	16.66
6.	Do you follow recommended spacing for late sowing (2 - 3 ft * 0.5 ft)	49	40.83	45	37.50	26	21.67
	Sowing						
7.	Do you taken up sowing in recommended month (Early sowing(May – June)	77	64.17	30	25.00	13	10.83
	Seed rate						
8.	Do you adapt recommended quantity of seeds / acre.(5to6 kg / acre)	65	54.17	33	27.50	17	14.17
	Transplanting						
9.	Have you followed transplanting in red gram	00	00.00	00	00.00	120	100
10.	Have you taken up recommended days old seedlings for transplanting (30 to 45 old day seedlings)	00	00.00	00	00.00	120	100
	Earthing up						
11.	Have you taken up earthing up in recommended days after sowing (30 to 50 days)	90	75.00	28	23.30	02	01.70
	Nipping						
12.	Do you taken nipping in recommended days after sowing in red gram (45 to 60 days)	80	66.67	29	24.17	11	09.16
	Inter cropping						
13.	Do you follow inter cropping with ragi in recommended proportion 8:2 / 6: 1	54	45.00	46	38.30	20	16.67
14.	Do you follow inter cropping with ground nut in recommended proportion 8:2 / 4: 1	59	49.17	58	48.33	03	02.50
	Initial phase Intercropping						
A.	Cowpea	62	51.67	41	34.17	17	14.16
B.	Avare	54	45.00	41	34.17	25	20.83
	Soil fertility management						
15.	Do you follow soil test based fertilizer	65	54.17	45	37.50	10	08.33
16.	Do you adapt recommended quantity of fertilizers (50 kg DAP + 15 kg MOP / acre)	67	55.83	40	33.33	13	10.84
17.	Do you follow recommended dosage of KCL /litr of water (10 grams / litre of water)	03	02.50	05	04.17	112	93.33
	Water soluble fertilizers						
18.	Do you follow recommended quantity of 19:19:19 foliar spray (2% or 20 grams / litre of water)	09	07.50	15	12.50	96	80.00
	Bio fertilizers						
19.	Do you use recommended bio fertilizers in recommended quantity.(Rhizobium:200gm/acre)	55	45.83	30	25.00	35	29.17
	PSB: 200 gm/ acre	00	00.00	00	00.00	120	100
	FYM application						
20.	Do you took recommended quantity of FYM/acre at recommended time (3 ton/acre about 2 to 3 weeks before sowing)	22	18.33	37	30.83	61	50.83
21.	**Nutrition management**						
	Have you followed recommended dosage of pulse magic/litre of water (10 gram / litre of water)	04	03.33	09	07.50	107	89.17
22.	**Water management**						
	Do you adapt the opening of dead furrow in red gram field for drainage purpose	55	45.83	32	26.67	33	27.50
	Pest and disease management						
23.	Have you used recommended quantity of trichoderma viridae for seed treatment (10 gms / kg of seeds)	22	18.33	35	29.17	63	52.50
24.	Have you used recommended no of pheromone trap to control sucking pest / scales (4 to 5 traps / acre)	12	10.00	21	17.50	87	72.50
25.	Have you used bird perches	51	42.50	47	39.17	22	18.33

Conclusion

The results revealed that a majority of big farm redgram growers had adopted more climate smart technologies in redgram cultivation compared to small farmers. Hence, the extension functionaries need to intensify their efforts in increasing the adoption level of small farm redgram growers particularly through adopting suitable extension strategies and providing critical inputs in time at subsidized rate.

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