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Assessing the knowledge and adoption of critical interventions among dryland farmers in redgram cultivation

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Abstract

Dryland farming is a crucial livelihood strategy for smallholder farmers, but it is vulnerable to climate change and water scarcity. This study evaluated the knowledge and adoption of critical interventions among 120 dryland farmers in redgram cultivation in the Prakasam district of Andhra Pradesh, India. The results showed that while farmers had good knowledge of basic practices like primary tillage and weed management, they lacked knowledge of advanced techniques like micro irrigation and anti-transpirants. The adoption of critical interventions was also low, with only 25% of farmers adopting micro irrigation and 15% adopting anti-transpirants. The study highlights the need for targeted extension programs to enhance farmers' knowledge and adoption of critical interventions for sustainable redgram cultivation.

Keywords: Dryland farming, redgram cultivation, critical interventions, knowledge, adoption

Introduction

FAO has defined drylands as those areas with a length of growing period (LGP) of 1-179 days (FAO, 2000) [4]; this includes regions classified climatically as arid, semi-arid and dry sub-humid. Based on the FAO Global Agro-Ecological Zones (GAEZ) modelling system (FAO, 2020) [5], drylands represent 43.20 percent of total global area in 2020, and are predicted to be 44.20 percent in 2050. Rainfed agro-ecosystems occupy a considerable place in Indian agriculture, covering 80 M ha in arid, semi-arid and sub-humid climatic zones; constituting nearly 57 percent of the net cultivated area. Rainfed agriculture supports 40 percent of human population and 60 percent livestock population. About 70 percent of rural population lives in rainfed areas and their livelihoods depend on success or failure of the crops (Rao *et al*., 2016) [9]. Climate change can act as a conflict threat multiplier, whereby already fragile ecosystems and local communities are pushed beyond coping capacity, resulting in increasing tensions related to natural resource access and use (IPCC, 2019) [6]. Productivity of rainfed agriculture continues to remain low due to multiple risks and constraints relating to biophysical and socio-economic issues (Rao *et al*, 2016) [9]. Advancement and adoption of moisture conservation technologies by the farmers may improve dryland crop productivity, farm income along with upliftment in their livelihood. Furthermore, harnessing every inch of rainfed lands by following highly efficient technologies is also need of the hour to feed the ever-increasing population (Kaur *et al*, 2022) [7]. Dryland farming is a crucial livelihood strategy for smallholder farmers in India, particularly in the rainfed regions of Andhra Pradesh, where agriculture is the primary source of income and employment. Redgram (*Cajanus cajan*) is a key crop in these areas, providing a source of income, nutrition, and food security for millions of farmers. However, dryland farming is vulnerable to various challenges, including climate change, water scarcity, soil degradation, and inadequate access to credit and markets, which can lead to reduced crop yields, decreased livelihood security, and increased poverty. To address these challenges, critical interventions such as conservation agriculture, micro irrigation, integrated nutrient management, and crop insurance are essential. These interventions can help farmers adapt to climate change, improve soil health, increase crop yields, and reduce risks. However, despite their importance, the adoption of these interventions among dryland farmers remains limited due to various factors, including lack of knowledge, inadequate extension services, high upfront costs, and limited access to credit and markets. In this context, assessing the knowledge and adoption of critical interventions among dryland farmers in redgram cultivation is crucial to identify the gaps in knowledge and adoption and inform the development of targeted extension programs. This study aimed to evaluate

the knowledge and adoption of critical interventions among dryland farmers in redgram cultivation in the Prakasam district of Andhra Pradesh, India. The findings of this study will provide valuable insights into the knowledge and adoption of critical interventions among dryland farmers in redgram cultivation and inform the development of effective extension programs to promote sustainable agriculture and improve the livelihoods of dryland farmers.

Methodology

The study employed a descriptive survey research design to assess the knowledge and adoption of critical interventions among dryland farmers in redgram cultivation. This design was chosen to gather information on the current state of knowledge and adoption of critical interventions among dryland farmers. The study was conducted in the Prakasam district of Andhra Pradesh, India. This region is characterized by dryland farming, making it an ideal location for the study.A sample size of 120 dryland farmers was selected for the study using a simple random sampling technique. A structured questionnaire was designed to collect data from the respondents. The questionnaire consisted of two sections: Knowledge and adoption. Knowledge test was developed for the study. Knowledge section evaluated farmers' knowledge of 28 critical interventions in redgram cultivation, including: Soil conservation techniques, Water harvesting and management, Crop management practices, Pest and disease management, Nutrient management. Respondents were asked to indicate their level of knowledge for each intervention using a 3-point scale. The adoption section assessed the extent of adoption of the 28 critical interventions among the respondents. Respondents were asked to indicate the extent of adoption for each intervention using a 5-point scale: Data were collected through personal interviews with the selected respondents. The pre tested interview schedule was administered by trained enumerators who ensured that the respondents understood the questions and provided accurate responses. Descriptive statistics, including frequency distributions, percentages, and ranking, were used to analyze the data. The data were analyzed using SPSS software.

Results and Discussion

Table 1: Content analysis of level of knowledge on critical interventions in redgram (n=120)

S. No.	Critical intervention*	Level of knowledge				Rank
		Correct		Incorrect		
		F	%	F	%	
1.	Deep summer ploughing	108	90.00	12	10	7
2.	Contour bunding	50	41.67	70	58.33	19
3.	Sowing of LRG-52, PRG-158 under delayed monsoon	30	25.00	90	75.00	24
4.	The appropriate time of sowing for *kharif* redgram	112	93.34	8	6.66	4
5.	Intercropping will suppress the weed growth	96	80.00	24	20.00	10
6.	Optimum and healthy crop stand in redgram	58	48.33	62	51.67	17
7.	Field must be kept weed free up to 30-50 days after sowing	114	95.00	6	5.00	3
8.	Inter cultivation after 20-25 days	110	91.67	10	8.33	6
9.	Minimum weedings required during the crop season	111	92.50	9	7.50	5
10.	Foliar application of urea @ 10 g/1litre in prevailing drought conditions	46	38.33	74	61.67	20
11.	Irrigation at flower bud initiation and pod filling stages	70	58.33	50	41.67	16
12.	Soils which is not suitable for redgram cultivation	106	88.33	14	11.67	8
13.	Short duration variety of Redgram	36	30.00	84	70.00	21
14.	The redgram variety suitable for *kharif* season in Prakasam district	18	15.00	102	85.00	27
15.	Recommended chemical used for seed treatment	29	24.17	91	75.83	25
16.	Recommended seed rate for *kharif* redgram	105	87.50	15	12.50	9
17.	Recommended spacing for *rabi* Redgram	95	79.17	25	20.83	11
18.	The process of improving the water retention in soil	80	66.67	40	33.33	14
19.	Important pests of redgram crop	81	67.50	39	32.50	13
20.	Primary tillage for *kharif* redgram is done during season	118	98.33	2	1.67	1
21.	Redgram variety LRG-30 resistant to	34	28.33	86	71.67	22
22.	Variety that is tolerant to terminal moisture stress	19	15.83	101	84.17	26
23.	Seed treatment in redgram with rhizobium culture	32	26.67	88	73.33	23
24.	Normal sowing window of rainfed redgram in *kharif*	115	95.83	5	4.17	2
25.	Intercropping ratio of redgram + ground nut	82	68.34	38	31.66	12
26.	Critical growth stages in redgram	72	60.00	48	40.00	15
27.	Trade names of anti-transpirants used in redgram	2	1.67	118	98.33	28
28.	Disease which will affect redgram under rainfed conditions	52	43.33	68	56.67	18

F: Frequency, %: Percentage * Multiple response format

Results furnished in the Table 1 revealed that 75 to 100 percent of the dryland farmers had knowledge about critical interventions in redgram in percentage rank order of their decreasing importance is: primary tillage for *kharif* redgram is done during season (98.33%) -1, normal sowing window for rainfed redgram in *kharif* (95.83%) -2, field must be kept weed free up to 30-50 days after sowing (95.00%) -3, the appropriate time of sowing for *kharif* redgram (93.34%) -4, minimum weedings required during the crop season (92.50%) -5, inter cultivation after 20-25 days (91.67%) -6, deep summer ploughing (90.00%) -7, soils which is not suitable for redgram cultivation (88.33%) -8, recommended seed rate for *kharif* redgram (87.50%) -9, intercropping will suppress the weed growth (80.00%) -10 and recommended

spacing for *rabi* redgram (79.17%) -11.

This can be inferred that 75 to 100 percent of the dryland farmers had knowledge regarding the primary tillage for *kharif* redgram is done during season, normal sowing window of rainfed redgram during *kharif*, field must be kept weed free up to 30-50 days after sowing, the appropriate time of sowing for *kharif* redgram, minimum weedings required during the crop season, Inter cultivation after 20-25 days, deep summer ploughing, soils which is not suitable for redgram cultivation, recommended seed rate for *kharif* redgram, intercropping will suppress the weed growth and recommended spacing for *rabi* redgram. The reason might be because these practices were very easy to understand and these were very basic practices need to understood by the farmers.

An overview of the table 1 also revealed that 50 to 75 percent of the dryland farmers had knowledge about critical interventions in the percentage rank order of their decreasing importance are, intercropping ratio of redgram + ground nut (68.34%) -12, important pests of redgram crop (67.50%) -13, the process of improving the water retention in soil (66.67%) -14, critical growth stages in redgram (60.00%) -15, irrigation at flower bud initiation and pod filling stages (58.33%) -16.

This can be inferred that 50 to 75 percent of the dryland farmers had knowledge about intercropping ratio of redgram + ground nut, important pests of redgram crop, the process of improving the water retention in soil, critical growth stages in redgram, irrigation at flower bud initiation and pod filling stages. This might be due to because of these are the important interventions needs to be understood by the farmer to save the crop from drought and crop failures.

An overview of the table 1 also revealed that 25 to 50 percent of the dryland farmers had knowledge about critical interventions in percentage rank order of their decreasing importance are, optimum and healthy crop stand in redgram (48.33%) -17, disease which will affect redgram under rainfed conditions (43.33%) -18, contour bunding (41.67%) -19, foliar application of urea @ 10 g/1litre in prevailing drought conditions (38.33%) -20, short duration variety of redgram (30.00%) -21, redgram variety LRG-30 resistant to (28.33%) -22, seed treatment in redgram with rhizobium culture (26.67%) -23 and sowing of LRG-52, PRG-158 under delayed monsoon (25.00%) -24.

This can be inferred that only 25 to 50 percent of the dryland farmers had knowledge about optimum and healthy crop stand in redgram, disease which will affect redgram under rainfed conditions, contour bunding, foliar application of urea @ 10 g/1litre in prevailing drought conditions, short duration variety of redgram, redgram variety LRG-30 resistant to, seed treatment in redgram with rhizobium culture, sowing of LRG-52 and PRG-158 under delayed monsoon. This can be due to lack of awareness among the farmers about foliar application of nutrients and also different short duration, resistant varieties and also lack of technical know-how about seed treatment with rhizobium.

An overview of the table 1 revealed that 0 to 25 percent of the dryland farmers had knowledge about critical interventions in percentage rank order of their decreasing importance are, recommended chemical used for seed treatment (24.17%) -25, variety that is tolerant to terminal moisture stress (15.83%) -26, the redgram variety suitable for *kharif* season in Prakasam district (15.00%) -27 and trade names of anti-transpirants used in redgram (1.67%) -28.

This can be inferred that only 0 to 25 percent of the dryland farmers had knowledge about recommended chemical used for seed treatment, variety that is tolerant to terminal moisture stress, recommended chemical used for seed treatment, variety that is tolerant to terminal moisture stress, the redgram variety suitable for *kharif* season in Prakasam district, trade names of anti-transpirants used in redgram. This is also might be due lack of awareness about chemical seed treatment, anti-transpirants and non-availability of seed treatment chemicals in small quantities which is required for small and marginal farmers and they felt that some of the practices mentioned above are difficult to understand because of illiteracy.

Results furnished in the Table 2 revealed that the 75 to 100 percent of the dryland farmers had extent of adoption on critical interventions in redgram in percentage rank order of their decreasing importance are, mechanical weed control measures (98.33%) -1, recommended seed rate (96.67%) -2, cultural weed control measures (95.83%) -3, normal sowing window during *kharif* and *rabi* (93.33%) -4, life-saving irrigations during severe moisture stress conditions (83.33%) -5, timely weed management (83.33%) -6, timely pest and disease management (76.67%) -7 and cultural pest management practices (75.00%) -8.

This can be inferred that 75 to 100 percent of the dryland farmers adopted critical interventions in redgram like mechanical weed control measures, recommended seed rate, cultural weed control measures, normal sowing window during *kharif* and *rabi*, life-saving irrigations during severe moisture stress conditions, timely weed management, timely pest and disease management, cultural pest management practices. The reason might be due to fact that they are easy to adopt and necessary practices required the cultivation of redgram.

An overview of the Table 2 revealed that the 50 to 75 percent of the dryland farmers had extent of adoption on critical interventions in redgram in percentage rank order of their decreasing importance are, alternate crops in case of delayed monsoon (68.33%) -9, recommended spacing (67.50%) -10, varieties resistant to diseases like fusarium wilt (60.00%) -11, foliar application of nutrients to mitigate drought conditions (56.67%) -12 and integrated nutrient management (55.00%) -13, compartmental bunding (50.00%) -14.

This can be inferred that 50 to 75 percent of the dryland farmers adopted critical interventions in redgram like alternate crops in case of delayed monsoon, recommended spacing, varieties resistant to diseases like fusarium wilt, foliar application of nutrients to mitigate drought conditions, integrated nutrient management, compartmental bunding.

Table 2: Content analysis of extent of adoption of critical interventions in redgram by dryland farmers (n=120)

S. No.	Critical Intervention*	Extent of Adoption				Rank
		Adopted		Not Adopted		
		F	%	F	%	
1.	Improved/high yielding varieties	36	30.00	84	70.00	18
2.	Drought tolerant varieties	20	16.67	100	83.33	23
3.	Seed treatment	19	15.83	101	84.17	24
4.	Conservative furrows	24	20.00	96	80.00	21
5.	Trench cum bunding measures	26	21.67	94	78.33	19
6.	Broad Bed and furrow system	25	20.83	95	79.17	20
7.	Compartmental bunding	60	50.00	60	50.00	14
8.	Normal sowing window during *kharif* and *rabi*	112	93.33	8	6.67	4
9.	Recommended seed rate	116	96.67	4	3.33	2
10.	Recommended spacing	81	67.50	39	32.50	10
11.	Mulching	4	3.33	116	96.67	27
12.	Anti-transpirants to reduce the evapo-transpiration losses	3	2.50	117	97.50	28
13.	Intercropping	52	43.33	68	56.67	15
14.	Alternate crops in case of delayed monsoon	82	68.33	38	31.67	9
15.	Short duration varieties to avoid moisture stress	44	36.66	76	63.34	17
16.	Micro irrigation techniques	14	11.67	106	88.33	25
17.	Life saving irrigations during severe moisture stress conditions	100	83.33	20	16.67	5
18.	Timely weed management	99	82.50	21	17.50	6
19.	Chemical weed control	50	41.67	70	58.33	16
20.	Mechanical weed control measures	118	98.30	2	1.70	1
21.	Cultural weed control measures	115	95.83	5	4.17	3
22.	Soil test-based fertilizer application	23	19.17	97	80.83	22
23.	Integrated nutrient management	66	55.00	54	45.00	13
24.	Foliar application of nutrients to mitigate drought conditions	68	56.67	52	43.33	12
25.	Farm ponds or percolation tanks	12	10.00	108	90.00	26
26.	Timely pest and disease management	92	76.67	28	23.33	7
27.	Cultural pest management practices	90	75.00	30	25.00	8
28.	Varieties resistant to diseases like Fusarium wilt	72	60.00	48	40.00	11

F: Frequency, %: Percentage *Multiple response format

An overview of the Table 2 also revealed that the 25 to 50 percent of the dryland farmers had extent of adoption on critical interventions in redgram in percentage rank order of their decreasing importance are, intercropping (43.33%) -15, chemical weed control (41.67%) -16, short duration varieties to avoid moisture stress (36.66%) -17 and improved/high yielding varieties (30.00%) -18.

This can be inferred that 25 to 50 percent of the dryland farmers adopted critical interventions in redgram like intercropping, chemical weed control, short duration varieties to avoid moisture stress, improved/high yielding varieties. The probable reason might be high cost of chemical herbicides and stigma in the farmers about usage of chemical herbicides and dryland farmers were using local varieties in redgram rather than using improved and high yielding varieties to reduce the cost of cultivation.

An overview of the Table 2 also revealed that the 0 to 25 percent of the dryland farmers had extent of adoption on critical interventions in redgram in percentage rank order of their decreasing importance are, trench cum bunding measures (21.67%) -19, broad bed and furrow system (20.83%) -20, conservative furrows (20.00%) -21, soil test based fertilizer application (19.17%) -22, drought tolerant varieties (16.67%) -23, seed treatment (15.83%) -24, micro irrigation techniques (11.67%) -25, farm ponds or percolation tanks (10.00%) -26, mulching (3.33%) -27 and anti-transpirants to reduce the evapo-transpiration losses (2.50%) -28.

This can be inferred that 0 to 25 percent of the dryland farmers adopted critical interventions in redgram like trench cum bunding measures, broad bed and furrow system, conservative furrows, soil test based fertilizer application, drought tolerant varieties, seed treatment, micro irrigation techniques, farm ponds or percolation tanks, mulching, anti-transpirants to reduce the evapo-transpiration losses. The reason might be due to lack of awareness and interest about *in-situ* moisture conservation technologies.

Conclusion

The study's findings underscore the importance of enhancing dryland farmers' knowledge and adoption of critical interventions for sustainable redgram cultivation. While farmers demonstrated strengths in basic practices, they require targeted support to adopt advanced techniques. Extension programs should focus on building farmers' capacity in areas like micro irrigation, anti-transpirants, and soil test-based fertilizer application. By addressing these gaps, we can promote sustainable redgram cultivation and improve the livelihoods of dryland farmers.

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