Original Research Article

Identifying Constraints to Dryland Farming: A Study of Technical, Socio-Personal, and Financial Barriersin Drought prone area ofAndhra Pradesh, India

ABSTRACT

Dryland farming is a crucial agricultural practice in many regions, but farmers face various constraints that hinder its adoption. This study investigated the technical, socio-personal, and financial constraints faced by dryland farmers in Prakasam district of Andhra Pradesh. A survey of 120 farmers revealed that technical constraints were the most severe, with insufficient availability of water (226 - I) and non-availability of quality seed in time (208 - II) being the top two constraints. Socio-personal constraints, such as illiteracy (188 - II) and inability to accept new practices (186 - III), were also significant. Financial constraints, including high cost of inputs (212 - I) and delay in sanction of loans (200 - II), were also major concerns. Friedman test results showed a significant difference between the different constraints ($p < 0.001$), with technical constraints having the highest mean rank (2.40). Wilcoxon signed rank test results revealed significant differences between technical and socio-personal constraints ($p = 0.009$) and financial and technical constraints ($p = 0.001$), but not between socio-personal and financial constraints ($p = 0.321$). These findings highlight the need to address technical constraints to improve adoption of critical interventions in dryland farming.

Keywords:dryland farming, technical constraints, socio-personal constraints, financial constraints, wilcoxon signed-rank test.

1. INTRODUCTION

Climate change is a unique issue of the 21stera and has affected many components of human life, the environment and overall ecosystems(Lemery*et al*., 2021 &Felician*et al*.,2022).Climate change has not only led to adverse effect on food security and sustainable community development but also negative environmental impact such as, drought, floods, increase in pest, and diseases and loss of livelihood by smallholder farmers (Kenduiwa*et al*., 2024).FAO has defined drylands as those areas with a length of growing period (LGP) of 1-179 days (FAO, 2000); 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), drylands represent 43.20 per cent of total global area in 2020, and are predicted to be 44.20 per cent 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 per cent of the net cultivated area. Rainfed agriculture supports 40 per cent of human population and 60 per cent livestock population. About 70 per cent of rural population lives in rainfed areas and their livelihoods depend on success or failure of the crops (Rao *et al*., 2016). 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). 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).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).creating awareness on climate change adaptation strategies by organizing more extension campaigns, training programs and providing subsidies or incentives for farmers will be motivate them to better adapt to climate change (Mounika *et al*, 2024).

As around 46 per cent of the gross sown area in Andhra Pradesh is under rainfed conditions, climate change will adversely influence crop yields and variability. According to the report by the Commission on Inclusive and Sustainable Agricultural Development of Andhra Pradesh (2016), out of the 645 non-urban mandals in the state, 129 have been identified as extremely resource-deprived. These mandals are predominantly located in Anantapuramu (51), Kurnool (30), Kadapa (24), and Prakasam (18). Notably, 64.30 percent of the 129 severely resource-deprived mandals are in the Rayalaseema and Prakasam districts. Prakasam has been considered highly vulnerable under Climate Change vulnerability on account of increased frequency of occurrence of drought /erratic monsoon. With over 60 per cent area under rainfed farming, sustaining the livelihood is a key challenge in the district. (NABARD, 2021). Moreover, Prakasam district has the highest area under dryland among coastal districts of Andhra Pradesh. The current situation necessitated a study to different types of constraints was facing by dryland farmers while cultivating major crops in the study area. Based on the findings, recommendations will be made to overcome the different constraints faced by the farmers in the study area.

2. METHODOLOGY

This study is to identify the constraints faced by dryland farmers in adopting critical interventions in major crops. The study was conducted in Prakasam district of Andhra Pradesh with a sample size of 120 dryland farmers utilizing an *Ex-post facto* research design. Prakasam district was selected because it has the largest dryland area in the coastal region of Andhra Pradesh, offering potential for increasing the production and productivity of dryland crops like cotton and redgram. Four mandals in Prakasam district were chosen based on their extensive dryland cultivation. Two villages from each of the selected mandals were randomly chosen, totaling eight villages. Fifteen farmers were randomly selected from each village, making a total sample of 120 farmers. A structured interview schedule was developed with input from experts across various agricultural disciplines to gather data for this study. The questions were designed to be simple and easy to answer. Each section contained questions related to the specific constraint, and respondents were asked to rate the intensity of each constraint (major constraint, minor constraint, or not a constraint). The schedule was pretested with 30 respondents in a non-sample area. Based on feedback, it was revised for clarity and ease of understanding. Building rapport with respondents was crucial. Initial days were spent getting acquainted with respondents using the help of extension personnel, *RaithuBharosaKendras* (RBKs), and local leaders, followed by informal visits. Data were collected in March and April 2021 through personal interviews conducted in Telugu. The interviewer personally recorded responses, ensuring accuracy and consistency. Personal interviews allowed the researcher to record first-hand information and observe respondents' reactions, ensuring a comfortable environment for open and honest responses. The data were coded, tabulated, and analyzed using appropriate statistical tests to meet the study's objectives. Findings were interpreted and discussed to draw meaningful conclusions. Descriptive statistics were used to analyze the data, including frequency distributions and percentages. The Friedman test was used to determine the mean rank of each constraint category (technical, socio-personal, and financial). Friedman's test determines whether the rank totals for each condition/treatment differ significantly from the values which would be expected by chance. The test statistic suggested by Friedman's is

$$T_1 = \frac{12}{nk(k+1)} \sum_{k=1}^{k} R^2 - 3n(k+1)$$

Where,

n= number of blocks (or subjects),

k= number of treatments (or conditions), and

Rj = sum of ranks assigned to each treatment.

The Wilcoxon signed-rank test (post-hoc test) was used to examine the significant differences between the different constraint categories.

3. RESULTS AND DISCUSSION

3.1 Problems Faced by the Dryland Farmers in the Adoption of Critical Interventions in Major Crops

The problems faced by the farmers were grouped into three categories namely, technical constraints, socio-personal constraints and financial constraints. Depending upon the intensity of the constraint (major constraint, minor constraint and not a constraint) the scores were assigned. Based on the total score, the ranks were assigned and the data is presented in Table 1.

Table 1 Constraints faced by the respondents (n=120)

S. No.	Type of constraint	Major constraint (2)		Minor constraint (1)		Not a constraint (0)		Total score	Rank
I	**Technical constraints**	**f**	**%**	**f**	**%**	**f**	**%**		
1.	Lack of timely weather-based information	36	30.00	82	68.33	2	1.67	154	X
2.	Non availability of quality seed in time	88	73.33	32	26.67	0	0.00	208	II
3.	Inadequate knowledge on intercrops to be grown	60	50.00	56	46.70	4	3.30	176	IX
4.	Inadequate knowledge on amount of seed required	66	55.00	46	38.33	8	6.67	178	VIII
5.	Non availability of improved machinery due to high cost	66	55.00	48	40.00	6	5.00	180	VII
6.	Non availability of seed treatment chemicals in small quantities	74	61.67	42	35.00	4	3.33	190	V
7.	Insufficient availability of water	106	88.33	14	11.67	0	0.00	226	I
8.	Inadequate knowledge on drought mitigation measures	80	66.67	40	33.33	0	0.00	200	III
9.	Lack of knowledge on water conservation techniques	79	65.84	41	34.17	0	0.00	199	IV
10.	Inadequate knowledge about foliar application of nutrients	70	58.33	46	38.33	4	3.33	186	VI
II	**Socio personal constraints**								
1.	Illiteracy of the farmer	70	58.33	48	40.00	2	1.67	188	II
2.	Inability to take risk	72	60.00	40	33.33	8	6.67	184	IV
3.	Inability to accept new practices	72	60.00	42	35.00	6	5.00	186	III
4.	Small size of the farm	62	51.67	52	43.33	6	5.00	176	V
5.	More interested to follow conventional practices	88	73.33	30	25.00	2	1.67	206	I
6.	Increasing labour scarcity	30	25.00	80	66.67	10	8.33	140	VII
7.	Lack of support from the villagers	54	45.00	64	53.33	2	1.67	172	VI
III	**Financial constraints**								
1.	Poor economic status of the farmer	17	14.17	95	78.33	8	6.67	129	VII
2.	High cost of inputs	94	78.33	24	20.00	2	1.67	212	I
3.	Inadequate support from financial	60	50.00	58	48.33	2	1.67	178	IV

	institutes								
4.	Delay in sanction of the loans due to stringent procedures followed by financial institutions	80	66.67	40	33.33	0	0.00	200	II
5.	High rate of interest charged by private money lenders	76	63.33	44	36.67	0	0.00	196	III
6.	Lack of savings	28	23.33	84	70.00	8	6.67	140	VI
7.	Flaws in crop insurance schemes	46	38.33	72	60.00	2	1.67	164	V

3.1.1 Technical Constraints

From the data, it was observed that insufficient availability of water (226 – I) was the major constraint expressed by dryland farmers followed by non-availability of quality seed in time (208 – II), inadequate knowledge on drought mitigation measures (200 – III), lack of knowledge on water conservation techniques (199 – IV), non-availability of seed treatment chemicals in small quantities (190 – V), inadequate knowledge about foliar application of nutrients (186 – VI), non-availability of improved machinery due to high cost (180 – VII), inadequate knowledge on amount of seed required (178 – VIII), inadequate knowledge on intercrops to be grown (176 – IX) and lack of timely weather-based information (154 – X).

The major problem in dryland farming is lack of irrigation water and hence this was perceived as major constraint by majority of the farmers. Most of the dryland farmers cannot take up seed production due to unfavourable weather conditions and often depend upon private seed dealers for seed. Moreover, the Bt. cotton seed has to be purchased from these dealers invariably and the farmers are confronted with the problem of quality seed and this might be the reason for most of them for expressing the availability quality seed as an important constraint. Due to illiteracy, most of the farmers lack knowledge on foliar application of nutrients. The findings clearly indicate that the Department of Agriculture has to create awareness through demonstrations and Farmers Field Schools on moisture conservation techniques, micro irrigation techniques and also regularly inspect the private seed dealers to avoid the sale of spurious seed.

3.1.2 Socio Personal Constraints

The constraints of dryland farmers with regard to socio personal aspects in the rank order were more interested to follow conventional practices (206 – I), illiteracy of the farmer (188 – II), inability to accept new practices (186 – III), inability to take risk (184 – IV), small size of the farm (176 – V), lack of support from the villagers (172 – VI), increasing labour scarcity (140 – VII).

Majority of the dryland farmers in the study area were old aged with low or no education. Hence, they were more interested to follow conventional practices. As most of the respondents were small and marginal farmers with poor financial resources, they were reluctant to accept new practices and bear the risk.

3.1.3 Financial Constraints

The constraints of dryland farmers with regard to financial aspects based on total score and rank order of their importance were high cost of inputs (212 – I), delay in sanction of the loans due to stringent procedures followed by financial institutions (200 – II), high rate of interest charged by private money lenders (196 – III), inadequate support from financial institutes (178 – IV), flaws in crop insurance schemes (164 – V), lack of savings (140 – VI), poor economic status of the farmer (129 – VII). To increase the rate of adoption of critical interventions the government needs to provide some incentives in the form of input subsidies.

Dryland farming is always associated with risk and farmers are also deprived of financial resources. This might be the reason for most of the farmers perceiving the high cost of inputs as major constraint. Due to their low educational status, they are not much aware of the modalities and procedures to be followed in getting loans in banks and depend on money lenders for borrowing money and hence these were also perceived as other important financial constraints by many of the respondents.

3.1.4 Analysis of Constraints Using Friedman Test and Wilcoxon Signed Rank Test (Post-Hoc)

Table 2 Mean rank by Friedman test for different constraints faced by farmers (n=120)

S. No.	Constraints	Mean Rank
1.	Technical constraints	2.40
2.	Socio personal constraints	1.98
3.	Financial constraints	1.62

Table 2 showed that the mean ranks obtained by the use of Friedman test was highest for technical constraints (2.40) which means that it was most severe constraint among all the three constraints. The reason for highest mean rank for technical constraints is due to medium to low extension contact and medium to low information seeking behaviour and lack of technical know-how about different dryland critical interventions especially insufficient availability of water, inadequate knowledge on drought mitigation measures, lack of knowledge on water conservation techniques and other in-situ moisture conservation measures.

Table 3 Test statistics of Friedman test for constraints (n=120)

S. No.	Statistics	Values
1.	n	120
2.	Chi-square value	22.804
3.	Degrees of freedom	2
4.	p - value	0.0001

Table 3further revealed that the p-value obtained from the Friedman test was 0.0001 (<5%). Hence it can be interpreted that there was a significance difference in between the different constraints faced by farmers in adoption of critical interventions in dryland farming. To examine whether the significant difference actually occurs between the different constraints faced by farmers in adoption of critical interventions in dryland farming, we need to run separate Wilcoxon signed rank test (post hoc) on the different combinations of constraints.

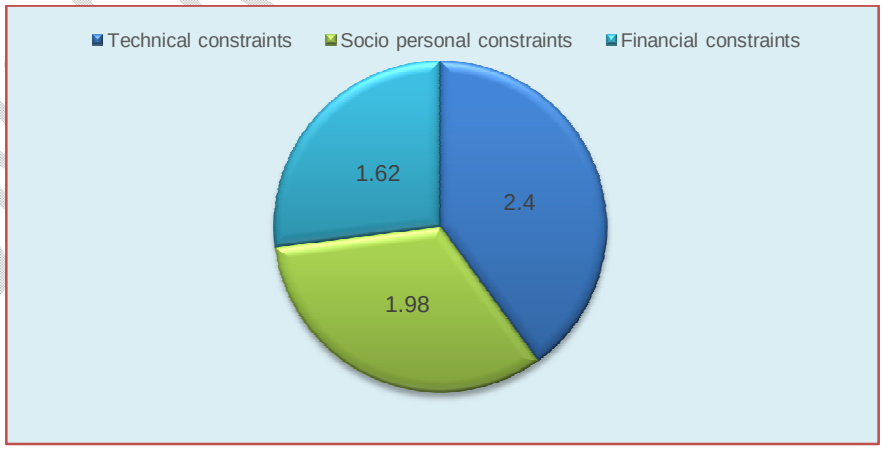

Fig. 1 Friedman mean rank for constraints

Table 4 Wilcoxon signed rank test (post hoc test) for constraints (n=120)

S. No.	Constraints	p - values

1.	Technical and socio personal constraints	0.009**
2.	Socio personal and financial constraints	0.321^{NS}
3.	Financial and technical constraints	0.001**
	Alpha value	0.05
	Level of significance	0.05/3 = 0.017

** : Significant ($p < 0.017$)

NS : Non-significant

Table 4 further revealed that there is a significant difference between the technical and socio personal constraints faced by the farmers because the p-value is 0.009 ($p<0.017$) and there is a non-significance difference between the socio personal and financial constraints faced by the dryland farmers because the p-value is 0.321 ($p>0.017$).

The Table 4 also showed that, there is a significance difference between the financial and technical constraints faced by the dryland farmers because the p-value is 0.001 ($p<0.017$).

From the analysed data, it can be concluded that there existed significant difference when technical constraints were combined with socio personal and financial constraints where as significant difference was not observed when financial and socio personal constraints were combined. The findings therefore indicate that there is a need to address the technical constraints which will in turn will address both financial and socio personal constraints.

4. CONCLUSION

This study identified and ranked the technical, socio-personal, and financial constraints faced by dryland farmers in adopting critical interventions in major crops. The findings revealed that technical constraints, particularly insufficient water availability and inadequate knowledge on drought mitigation measures, were the most severe constraints. Socio-personal constraints, such as illiteracy and conventional practices, and financial constraints, including high input costs and limited access to credit, also significantly impacted farmers. The study highlights the need for targeted interventions to address technical constraints, which will in turn address financial and socio-personal constraints. Specifically, the Department of Agriculture should create awareness on moisture conservation techniques, micro-irrigation, and quality seed availability, while the government should provide incentives in the form of input subsidies to increase the adoption of critical interventions. Addressing these constraints will enhance the productivity and sustainability of dryland farming, ultimately improving the livelihoods of dryland farmers.

Disclaimer (Artificial intelligence)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

REFERENCES

1. Commission on inclusive and sustainable agricultural development of Andhra Pradesh. 2016. Revitalizing rainfed agriculture of Andhra Pradesh.
2. Directorate of Economics and Statistics, Government of Andhra Pradesh. Agricultural Statistics at a glance. pp.8-16; 2020
3. District Planning Office, Prakasam. District Hand Book of Statistics. 2018.
4. FAO. Agriculture: towards 2015/30. Technical Interim Report. Economic and Social Dept., FAO, Rome; 2000.
5. FAO. Towards a global programme on sustainable dryland agriculture. Food and Agriculture Organization of the United Nations, Rome; 2020.
6. Feliciano, D., Recha, J, Ambaw, G., MacSween, K., Solomon, D., Wollenberg,E.. Assessment of agricultural emissions, climate change mitigation and adaptation practices in Ethiopia. Climate Policy. 2022;1–18.

IPCC. Climate Change and Land (special report); 2019. Accessed 20 June 2024. Available: https://www.ipcc.ch/srccl/.
7. Kaur, R., Kumar, S. and Jaidka, M. Increasing crop productivity in dryland/rainfed areas for achieving the sustainability goal of zero hunger. Indian Farming. 72 (07): 07-10; 2022.
8. Kenduiwa, Angela A., Charles W. Recha, Rose A. Mwonya, and AdijahOlubandwa. Extent of Adoption of SelectedClimate-Smart Agricultural Practices Among Smallholder Farmers in Laikipia County, Kenya. International Journal of Environment and Climate Change. 14 (9):112-23; 2024.
9. Lemery J, Knowlton K, Sorensen C. Global climate change and human health: from science to practice: John Wiley & Sons; 2021.8.
10. Mounika, B., M. C. Ahire, Kotha Shravani, and Chinni Venkata Sai Bharath. Relationship Between Socio Economic Profile and Adaptation Strategies of Maize Farmers to Climate Change in Maharashtra, India. International Journal of Environment and Climate Change 14 (9):164-71; 2024.
11. NABARD. Potential Linked Credit Plan (Prakasam). National Bank for Agriculture and Rural Development, Andhra Pradesh Regional Office; 2021.
12. Rao, Ch. S., Gopinath, K.A., Prasad, Y.G., Sikka, A.K. and Singh, R. Climate Resilient Rainfed Agriculture status and strategies. Indian Farming. 66(2): 02–06; 2016.