Original Research Article

CONSTRAINTS FACED BY PADDY FARMERS – A STUDY IN TELANGANA STATE

ABSTRACT

The present investigation was conducted during 2021-22 to assess the constraints faced by the paddy farmers. Findings revealed that, constraints such as high cost of seed varieties (71.18), lack of knowledge and skill for determining economic threshold level of pests and diseases (68.75), labour scarcity due to Mahatma Gandhi National Rural Employment Guarantee Scheme (79.35), labour scarcity during peak operations (76.06), insufficient finance with farmers (72.32), high rental charges for farm machinery (60.32), lack of new technologies and uneconomically viable solutions for residue management (82.62), lack of knowledge about input management (73.23), lack of information about government schemes (81.03), lack of information about recent pest-management strategies (74.11) were the first and second priority constraints. Thus, Government organisations, NGO's, ATMA, KVK's, DAATC's, SAU's should look after certain issues such as providing seeds at affordable cost , Mahatma Gandhi National Rural Employment Guarantee Scheme must give prioritize to agricultural field operations along with other activities, crop loan must be sanctioned to every farmer by considering crop yield assurance and bring out new technologies like happy seeder to remove residues but also allows the farmer to seed the new crop without involving manual labour which saves time and money for the farmers.

Keywords: Constraints, Garrette scores, Paddy farmers, Paddy farming sustainability.

1. INTRODUCTION

Paddy is one of the most important cereal crops cultivated worldwide. The current annual production of 524 million tons to 700 million tons by the 2025 using less land, less people, less water, and fewer pesticides, is a big concern. The irrigated rice area currently occupies about 56 per cent of total area and contributes to 76 per cent of total production. United States Department of Agriculture (November, 2022) had estimated the global availability of rice at 67.10 million tons in 2019-20 marketing season. India ranks first in rice area (43.9 million ha.) and second in production (106.5 million tons) in 2013-14 (Agricultural Market Intelligence Centre (2021)). The present study aimed to assess constraints of paddy

(

UNDER PEER REVIEW

farmers comprising the data from three different zones of the Telangana state. During last three decades, paddy has shown steady increase in demand and playing pivotal role in strategic food security, in planning and developing policies of many countries (Food and Agricultural Organisation, 2021). Asian countries cover more than 90 percent under paddy area which accounts about 92 per cent of world's production and Asians consumes about 90 per cent of global, major growing countries being China, India, Indonesia, Bangladesh, Thailand, Japan, Pakistan, Burma and Brazil (Papademetriou, 2022). The three basic dimensions and levels for assessing agriculture sustainability such as Normative, spatial and temporal. The normative dimension included ecological, economic and social aspects, while spatial dimension included local, regional and national whereas temporal includes long term and short term (Zhen and Routray, 2003 and Hayati *et al.*, 2010). A study in Kashmir to evaluate the barriers to farmers implementing recommended agricultural practises in paddy cultivation. These barriers included lack of skill in seed treatment (98.88 %), a lack of technical advice for seed storage (93.33 %), irregular visits from agricultural officers (94.44 %), a low rate of paddy in the local market (84.44 %), a high rate of seeds (72.73 %) and insufficient and unsuitable irrigation systems (Matto *et al.*, 2017). Based on findings of the second phase of our research, 83.00 per cent of the farmers fertilised their crop during the rice-growing season. The primary reasons why these farmers did not fertilise their crops were economic constraints (58.82 %), unfavourable environmental conditions (11.76 %) or lack of fertiliser availability at the required period (58.88 %). In riparian wetlands, it is significant to remember that, some local farmers were subsistence growers. They frequently lacked the financial resources necessary to buy fertiliser. Following transplantation, the majority of farmers (91.57 %) applied only inorganic fertilisers to rice crops, with nitrogen accounting for 64.23 per cent of all inorganic fertiliser applications. This is consistent with the findings of the first part of our study (Lakitana *et al.*, 2018). Majority of the respondents in the head reach area reported inadequate information and guidance about climate resilient technologies (Rank I) with a mean score of 2.66, followed by limited extension activities about these technologies (Rank II) with a mean score of 2.54, non-availability of labour to adopt these technologies (Rank III) with a mean score of 2.36 and non-availability of critical inputs (Rank IV) with a mean score of 2.36, low power (Rank VII) with a mean score of 1.80, followed by high input costs (Rank V) with a mean score of 2.12, uneven and erratic rainfall (Rank VI) with a mean score of 2.04, erroneous timing for water release from canals (Rank VIII) with a mean score of 1.74, small land holdings (Rank IX) with a mean score of 1.62 and monocropping (Rank X) with a mean score of 1.44 (Manjunath, 2018). Various constraints

UNDER PEER REVIEW

perceived by farmers in integrated farming system (IFS) were classified into five categories. The most significant restriction among them was the marketing constraint (mean score 2.43), followed by the financial (2.23), production (2.20), situational (2.11) and the organisational constraint (1.92). Main challenges farmers encountered included lack of local marketing resources, price swings, lack of storage for perishable farm products and low prices for the output (Parmar, 2018). Constraints encountered by the farmers in paddy cultivation were lack of sufficient irrigation (100.00 %), heavy floods during crop period (98.33 %), labour scarcity during peak season (97.50 %), lack of timely availability of quality seed (91.66 %), improper land preparation (85.00 %), significant labour cost at the time of the transplant (83.33 %), drought during crop season (82.50 %), disease and pest infestation (76.67 %), indiscriminate use of plant protection chemicals (74.16 %), stray cattle disturbances (70.83 %), and non-availability of sufficient FYM (58.33 %), imbalanced application of fertilizer (47.50 %) were the major constraints (Wakhet, 2019). Labour high wages during harvesting season (Z score= 0.13), costly machinery in management practices (Z score= 0.74), uneconomically viable solutions for residue management (Z score= 0.44), field residue incorporation or collection is expensive (Z score= -0.42) and cost of transportation is higher (Z score= 0.89) were serious economic constraints encountered in adoption of crop residue management practices. Whereas on the other hand, delays in the tool subsidy payments (Z score= -1.79) was encountered as not so serious constraint (Sharma, 2021). The Indonesian government needs to emphasize more on the technology dimension due to its low sustainability. Without technological innovation, it is challenging to establish sustainable rice farming, which will put the nation's ability to control its own food supply in danger. In addition, the study was used as a reliable source when evaluating the success of government initiatives to boost rice production that is sustainable. The formulation of follow-up and feedback in response to the evaluation findings about the provinces with the lowest degree of sustainability conditions and the most significant indicators should also be adopted by policymakers (Mucharam, 2022).

2. MATERIAL AND METHODS

The present research investigation employed Ex-post-facto-research design as the event has already happened. The study aimed to assess constraints of paddy farmers. These constraints were classified into five categories such as nine items (ecological), eight items (social), eight items (economic), six items (technical) and six items (institutional) dimensions comprising the data from three different zones of the Telangana state. Three districts namely

UNDER PEER REVIEW

Nizamabad, Khammam and Nalgonda representing each zone of Telangana state was selected for the purpose respectively during the year 2021-2022 as these three districts had more paddy area compared to other districts. Purposive sampling technique was employed for data collection from 216 paddy growing farmers by standardized and pre-tested interview schedule. Likewise, two blocks from each district were selected based on paddy area which constitutes a total of six blocks. Again, from each block, three villages were selected by using simple random technique comprising 18 villages. In each identified village, 12 farmers were selected by using simple random technique. So, 72 respondents were selected from each district. Thus, the total sample constituted for the purpose was 216 farmers who were the respondents of the investigation. Response of each statement was rated on three-point continuum namely Most serious, Somewhat serious, Likely serious with the scores of 3, 2 and 1 for positive statements and 1, 2 and 3 for negative statements, respectively. The data was subjected to Henry Garrett ranking technique to assess the constraints faced by the paddy farmers.

2.1 Henry Garett ranking technique

Henry Garrett ranking technique was used to assess the constraints faced by the Paddy farmers. As per the technique, the respondents were asked to rank the given attribute according to the magnitude of the problem. The orders of merit given by the participants were converted into ranks by using the following formula.

$$\text{Per cent position} = \frac{100\,(\text{Rij} - 0.5)}{\text{Nj}}$$

Where,

Rij = Rank given for the ith item jth individual

Nj = Number of items ranked by jth individual

The per cent position of each rank obtained was converted into scores by referring to the table given by Henry Garrett. Then for each factor, the scores of individual respondents were added together and divided by the total number of respondents for whom the scores were added. The mean scores for all the factors were arranged in the order of their ranks and inferences were drawn.

3. RESULTS AND DISCUSSIONS

Constraint analysis has become an important thrust area of extension research in recent days. The constraint analysis would help to lubricate the process of diffusion of new technologies among paddy farmers. The constraints experienced by paddy farmers were analysed using the Garrett Ranking score and presented hereunder.

UNDER PEER REVIEW

3.1 Ecological Constraints faced by the Paddy farmers in farming sustainability

The data presented from table 1. shows that majority of the farmers expressed the problem with high cost of seed varieties (71.18), followed by lack of knowledge and skill for determining ETL of pests and diseases (68.75), dominance of agro-chemical industry (66.59), lack of awareness about the effectiveness of IPM-INM practices (60.27), lack of knowledge about manual or mechanical methods (48.22), lack of skill in using IPM tools such as light trap, Pheromone trap etc. (41.90), mono cropping (27.55), limited adoption of IPM-INM practices on community basis (26.40) and occurrence of showers during harvest results decline yield (14.92) were the least observed constraints.

Table 1: The rank order of ecological constraints faced by the paddy farmers.

S. No.	Statements	GRS	Rank
1	High cost of seed varieties	71.18	I
2	Lack of knowledge and skill for determining ETL of pests and diseases	68.75	II
3	Dominance of agro-chemical industry	66.59	III
4	Lack of awareness about the effectiveness of IPM-INM practices	60.27	IV
5	Lack of knowledge about manual/mechanical methods.	48.22	V
6	Lack of skill in using IPM tools such as light trap, Pheromone trap etc.	41.90	VI
7	Mono cropping	27.55	VII
8	Limited adoption of IPM-INM practices on community basis.	26.40	VIII
9	Occurrence of showers during harvest results decline yield	14.92	IX

GRS = Garrett Ranking Score

Majority of the farmers had insufficient knowledge and skill in determining economic threshold level of pest and disease occurrence as they were unaware of less damage to crop than severe loss and effectiveness of integrated pest management (IPM) and integrated nutrient management (INM) practices. Dominance of agrochemicals leads to indiscriminate use of agrochemicals rather than recommended dose. Insufficiency of knowledge and skill about manual or mechanical methods, even using IPM tools such as light trap, pheromone

UNDER PEER REVIEW

traps due to less exposure. During the beginning of the season, when all the farmers wanted the seed varieties, the input dealers raised the prices. In a short period of time, government organisations dispersed seeds on a first come, first served basis, and all farmers were unable to obtain government-supplied seeds. Late comers may not always be able to obtain seeds on a subsidy basis. They believed that, seeds from government agencies and private input agencies were available when not needed, seed quality was low and sometimes there was adulteration of seeds by some dealers. The availability of quality seed was a problem faced before the beginning of the season. Even if seed was available, it was costly and the farmers have to transport it from faraway places and to incur additional costs on transport. Hence, they felt that extension personnel should come with a programme of seed village by which they will get the seed at local level which will be cheaper and also of superior quality. Farmers also stated that, the State Department of Agriculture should assure timely supply of HYV seed or quality seed to farmers, which has always been an issue for them. The land productivity was high due to less mono cropping. Less adoption of IPM-INM practices on community basis due to less farmer-to-farmer approach. When summer showers coincided with paddy harvesting in some locations, the crop was severely damaged. The crop was susceptible to lodging due to strong summer showers and wind gales and due to which the farmers were losing almost entire crop. This result is in accordance with the results of Shivamurthy (2008), Ahmed (2013), Narayana (2013), Rajendra (2013), Gonibasappa (2015), Ram (2015), Matto *et al.* (2017) and Wakhet (2019).

3.2 Social Constraints faced by the Paddy farmers in farming sustainability

It was evident from table 2. that majority of the farmers expressed that, labour scarcity due to MGNREGS (79.35), followed by scarcity of labour during peak agricultural operations (76.06), high cost and wages of labour during transplanting and harvesting season (73.35), Unskilled labour or inadequate availability of skilled labour (71.18), lack of proper storage facilities (68.15), lack of knowledge about storage pests and diseases (61.28), lack of sufficient training in operation of improved farm machinery (55.05) and increasing processing costs (54.37) were the least observed constraints.

Table 2: The rank order of social constraints faced by the paddy farmers.

S. No.	Statements	GRS	Rank
1	Labour scarcity due to MGNREGS	79.35	I

UNDER PEER REVIEW

2	Scarcity of labour during peak agricultural operations	76.06	II
3	High cost and wages of labour during transplanting and harvesting season	73.35	III
4	Unskilled labour/Inadequate availability of skilled labour	71.18	IV
5	Lack of proper storage facilities	68.15	V
6	Lack of knowledge about storage pests and diseases	61.28	VI
7	Lack of sufficient training in operation of improved farm machinery	55.05	VII
8	Increasing processing costs	54.37	VIII

GRS = Garrett Ranking Score

When the demand for labour is huge during peak seasons, they are not available at the local level. Labour shortages have significant impact on the sustainability of paddy growing. Moreover, as a result of several government schemes and activities in Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGP), Agricultural activities should be prioritised in the MGNREGP initiative. According to the farmers, because of the allocation of non-agricultural activities, the majority of farm labour is going to participate in the MGNREG because of assured income. Because of this, farmers are having lot of challenges, especially with labour-intensive procedures like transplanting, weeding and harvesting, which forces farmers to rely on manpower from other districts and other places, raising labour costs and forcing farmers to succumb numerous demands, which is highly expensive during peak periods. As a result, they expressed that, agricultural-related activities should be prioritised in the MGNREG so that farmers have access to workforce at the local level. The government should devise some scheme in which local labour collaborates with farmers and government funds are allocated to the labour which will help the labour and farmers also. The productivity of physical labour has become a major issue. This could be due to lack of expertise required for rice production. They were also losing their produce in storage because it was attacked by various storage grain pests and disease when stored at the local level and they were also not getting a good market price most of the time when all of the farmers took their produce to market at the same time, even they believed that processing facilities such as rice mills did not exist in all villages. This forced farmers to rely on the will

UNDER PEER REVIEW

and desires of millers at all times. According to the farmers, they were unable to store the produce for a longer period of time, which would benefit them in obtaining a good market price. Due to unpredictable precipitation, the crop was sometimes drenched on the field itself. The traditional storage methods were inadequate. Hence, farmers stated that, while extension professionals were always interested in making advice for major pests and diseases, when questioned about storage pests and diseases, they were unable to provide adequate knowledge which is an important aspect needs due consideration.

The farmers also expressed that, there were no appropriate implements for the intercultural operations for few activities like transplantation, which required specialised equipment or improved machinery. They were unable to operate the available or improved machinery. Thus, they had to spend a lot of money on workers for these activities. Most of them were having difficulty in processing because millers had a strong hand in charging high rates during peak periods. Similar results were observed in the studies of Shivamurthy (2008), Jayshree (2010), Narayana (2013), Rajendra (2013), Ram (2015), Matto *et al.* (2017), Parmar (2018), Wakhet (2019) and Sharma (2021).

3.3 Economical Constraints faced by the Paddy farmers in farming sustainability

It could be noticed from the table 3. that majority of farmers had problem with respect to the insufficient finance with the farmers (72.32) followed by high rental charges of certain farm machinery during peak season (60.32), lack of knowledge updates on market prices and fluctuations (55.36), involvement of middlemen in marketing of produce (52.32), distress sale and lack of profitable marketing system (50.32), lack of inclusion of latest farm machinery under subsidy (48.32), increasing cost of plant protection chemicals (46.98) and lack of co-operative societies for the purchase of produce (44.21) were the least observed constraints.

Table 3: The rank order of economical constraints faced by the paddy farmers.

S. No.	Statements	GRS	Rank
1	Insufficient finance with the farmers	72.32	I
2	High rental charges of certain farm machinery during peak season	60.32	II
3	Lack of knowledge updates on market prices and fluctuations	55.36	III

UNDER PEER REVIEW

4	Involvement of middlemen in marketing of produce	52.32	IV
5	Distress sale and lack of profitable marketing system	50.32	V
6	Lack of inclusion of latest farm machinery under subsidy	48.32	VI
7	Increasing cost of plant protection chemicals	46.98	VII
8	Lack of co-operative societies for the purchase of produce	44.21	VIII

GRS = Garrett Ranking Score

Farmers indicated that, they had to rely on middlemen due to the need for money at vital periods of crop growth because institutional and government bodies were taking longer to sanction loans and the sanction procedures were extremely lengthy. Furthermore, the middlemen lending money at exorbitant interest rates forced the farmers into a vicious cycle of debt. The farmers believed that for some of the more complex activities, such as transplanting and harvesting, which required more effort, the implements were not accessible on time during peak season. Recently innovated machinery were not exactly suited to them. One important implement needed was mechanical transplanter, which had been invented but was unsuitable for particular fields and needed to be modified. Harvesting equipment such as combine harvesters were heavy and unsuitable for tiny plots and wet terrain; the machinery frequently gets caught in the mud. They also stated that they lacked the necessary expertise to operate latest farming machinery and that they needed training in this area.

They also stated that during harvest, they had to rely on middlemen to sell the produce promptly at the local level because, some farmers did not have the capacity to transport their produce to distant market yards. They also felt that, the market price was sometimes very low even at the market yards. Due to the farmer's reliance on the intermediaries to secure quick loans and poor market conditions, they were forced to sell their distressed produce solely at the village level. As they don’t have price criteria at different periods and that no organisation was interested in assisting small and marginal farmers in forecasting the price of their produce at different times. In addition, they also thought that whenever they took their produce to the market believing that the prices were favourable, the prices fell within one or two days and the fluctuation was quite significant, benefiting the commission agents of the market yards but not the farmers. They believed that input dealers were selling more expensive pesticides and weedicides and that some of the prescribed chemicals were unavailable on the market when they were most required, farmers believed that input dealers

UNDER PEER REVIEW

lacked knowledge of pesticide and weedicide technologies and application recommendations. They also concluded that plant protection chemicals from government and private input sources were available when not needed. Thus, they stated that earlier, rice growers' societies, cooperatives or even seed was available locally as there was farmer to farmer exchange on many situations, but that cooperation among farmers has been dwindling day by day. The results were in agreement with the findings of Manoj *et al.* (2003), Nhemachena and Hassan (2007), Shivamurthy (2008), Jayshree (2010), Dhenge (2013), Narayana (2013), Rajendra (2013), Ram (2015), Matto *et al.* (2017), Lakitana *et al.* (2018), Parmar (2018) and Sharma (2021).

3.4 Technical Constraints faced by the Paddy farmers in farming sustainability.

The constraints experienced by the farmers in technological aspects are shown in Table 4. Lack of new technologies and uneconomically viable solutions for crop residue management (82.62) followed by lack of knowledge about input management (73.23), complexity of improved technologies (65.72), lack of knowledge and guidance on climate resilient technologies (64.30), existence of adulteration in plant protection chemicals (63.46) and limited extension interactions on climate resilient technologies (42.85) were least observed constraints.

Table 4: The rank order of technical constraints faced by the paddy farmers.

S. No.	Statements	GRS	Rank
1	Lack of new technologies and uneconomically viable solutions for crop residue management	82.62	I
2	Lack of knowledge about input management	73.23	II
3	Complexity of improved technologies	65.72	III
4	Lack of knowledge and guidance on climate resilient technologies	64.30	IV
5	Existence of adulteration in plant protection chemicals	63.46	V
6	Limited extension interactions on climate resilient technologies	42.85	VI

GRS = Garrett Ranking Score

Which states that non adoption of happy seeder, mulcher machine or other bioagents for residue management, they were unable to manage critical inputs as complexity in

UNDER PEER REVIEW

improved practices and lack of knowledge among farmers, a lack of awareness about climate resilient technologies and less extension activities related to it, plant protection chemicals were of poor quality and were occasionally contaminated by some dealers and even lack of demonstrations and training programmes by extension workers in some villages. The results were in agreement with the findings of Shivamurthy (2008), Philip *et al*. (2013), Rajendra (2013), Manjunath (2018), Ram (2015) and Sharma (2021).

3.5 Institutional Constraints faced by the Paddy farmers in farming sustainability

The respondents perceived some of the problems with respect to the institutional constraints. From table 5. it could be observed that the majority of the farmers were facing lack of information about government schemes (81.03), followed by lack of information about recent pest-management strategies (74.11), lack of periodical training to extension personnel (69.07), lack of support and technical guidance from agricultural department and extension personnel (54.12), less number of demonstrations on sustainable technologies (42.96) and lack of involvement of IPM and INM experts (34.79) were least observed constraints.

Table 5: The rank order of institutional constraints faced by the paddy farmers.

S. No.	Statements	GRS	Rank
1	Lack of information about government schemes	81.03	I
2	Lack of information about recent pest-management strategies	74.11	II
3	Lack of periodical training to extension personnel	69.07	III
4	Lack of support and technical guidance from agricultural department and extension personnel	54.12	IV
5	Less number of demonstrations on sustainable technologies	42.96	V
6	Lack of involvement of IPM and INM experts	34.79	VI

GRS = Garrett Ranking Score

Lack of information about government schemes like Pradhan Mantri Fasal Bima Yojana provides insurance to farmers in situations of crop loss. Pests such as brown plant hopper, leaf folder, stem borer and others, as well as diseases such as blast, sheath blight and bacterial leaf blight, have been causing significant losses to farmers in recent years. Farmers

UNDER PEER REVIEW

stated that the varieties with a high market price were prone to pests and diseases, whereas other varieties that were resistant to pests and diseases lacked a high market price and popularity. As a result, they recommended that research efforts should be made to generate varieties that are resistant to pests and diseases, have good cooking quality, popularity and market demand.

In terms of extension limits, farmers stated that extension professionals were not always involved in agriculture and were given additional tasks and that in some regions, field extension staff was also quite limited. This resulted in the extension personnel's sluggish efforts. Farmers also expressed that extension personnel were not properly trained or have the technical expertise to provide solutions to the farmers' recent concerns. They were suggesting old plant protection chemicals despite the fact that new chemicals were on the market. Thus, farmers perceived a very high extension worker-to-farmer ratio and involvement of experts were less due to other research engaged works. Similar results were observed in the studies of Jones (2003), Nzeadibe *et al.* (2011), Dhenge (2013), Narayana (2013), Rajendra (2013), Ram (2015) and Matto *et al.* (2017).

4. CONCLUSION

Increasing use of inputs such as fertilizer application and equipment, sustainable practices adoption has become necessary for sustainable farming. Sustainable practices boost output, while having no detrimental influence on environment. The simultaneities among adoption of sustainable practices can be examined in future research. This may help policymakers to understand factors influencing on farmers while adopting sustainable practices. Results revealed farmers' adoption choices are heavily influenced by availability of advisory services, education, economic motivation, level of aspiration and risk orientation. As line departments and governments should make it possible for farmers to learn more about sustainable practices. Since a long time, the availability of extension workers per unit farm family has been a serious concern and in certain areas, farmers have indicated that extension workers do not visit them even once a month, rendering extension operations essentially non-existent. The extension worker-to-farmer ratio was extremely high. As a result, they advocated for the recruitment of adequate extension personnel, which would pave the way for fresh agricultural graduates to enter the state department of agriculture, revitalising it.

REFERENCES

1. Agricultural Market Intelligence Centre. Paddy Outlook in July, Professor Jayashankar Telangana State Agricultural University, 2021.

UNDER PEER REVIEW

2. Ahmed, S. Factors and constraints for adopting new agricultural technology in Assam with special reference to Nalbari district: An empirical study; 2013.
3. Dhenge, S.A. Knowledge and adoption of integrated pest management practices by paddy growers, M.Sc. (Ag) Thesis, Dr. PDKV, Akola; 2013.
4. Food and Agriculture Organisation of United Nations. The State of food security and nutrition in the world. Rome, Italy. 2021; pp. 240. ISBN: 978-92-5-134325-8.
5. Gonibasappa. Impact of Integrated pest management on Paddy production in Uttara Kannada district of North Karnataka-An economic analysis. M.Sc. (Agri.) Thesis, Department of Agricultural Economics, College of Agriculture, University of Agricultural Sciences, Dharwad; 2015.
6. Hayati, D., Ranjbar, Z and Karami, E. Measuring agricultural sustainability. In: Biodiversity, Biofuels, Agroforestry and Conservation Agriculture, Netherlands, 2010, *Springer*. pp. 73-100.
7. Jayshree, U. Utility Perception of farmers about attributes of PKV-Khamang variety of Paddy, M.Sc. (Agri.) Thesis, Dr. P.D.K.V, Akola; 2010.
8. Jones, J.W. Agricultural responses to climate variability and climate change. Paper presented at Climate Adaptation.net conference "Insights and Tools for Adaptation: Learning from Climate Variability." Washington, DC: 18-20; 2003.
9. Lakitana, B., Hadib, B., Herlindaa, S., Siagac, E., Widuric, L. I., Kartikac, K., Lindianac, L., Yunindyawatid, Y., Meihanac, M. Recognizing farmers' practices and constraints for intensifying rice production at Riparian Wetlands in Indonesia, Wageningen Journal of Life Sciences. 2018, 85(1): 10-20.
10. Manjunath, K. V. Knowledge and adoption of climate resilient technologies among paddy growers in Mandya District, M.Sc. (Agri.) Thesis, Department of Agricultural Extension, University of Agricultural Sciences, Bengaluru; 2018.
11. Manoj, R.B., Isaacson and Dardel, P. Identifying policy determinants of food security response and recovery in the SADC region*:* The case of the 2002 food emergency. Policy Paper, FANRPAN; 2003.
12. Matto J. M., Shah M. A., Beigh Z. A and Mir R. Constraints faced by the Paddy growers in adoption of recommended Paddy production practices in Budgam District of Kashmir, International Journal of Current Microbiology and Applied Sciences. 2017; 61: 206-1214.
13. Mucharam, L., Rustiadi, E., Fauzi A and Harianto. Assessment of Rice Farming Sustainability: Evidence from Indonesia Provincial Data, International Journal of Sustainable Development and Planning. 2022; 15(8): 1323-1332.
14. Narayana, N., S. Constraint analysis of rice farmers of Nellore District of Andhra Pradesh, M.Sc. (Agri.) Thesis, Department of Agricultural Extension, Acharya N. G. Ranga Agricultural University, Rajendranagar, Hyderabad; 2013.
15. Nhemachena, C and Hassan, R. Micro-level analysis of farmers' adaptation to climate change in Southern Africa, IFPRI Discussion Paper No. 00714, International Food Policy Research Institute. 2007; Washington DC, USA.
16. Nzeadibe, T.C., Egbule, C.L., Chukwuone, N.A and Agu, V.C. Climate change awareness and adaptation in the Niger Delta Region of Nigeria. African Technology Policy Studies Network (ATPS) Working Paper Series. Nairobi: ATPS; 2011.

UNDER PEER REVIEW

17. Papademetriou, M. K. Rice production in the Asia-Pacific region: issues and perspectives, 2022, https://www.fao.org/3/x6905e/x6905e04.html.
18. Parmar, H. Awareness and perception of Integrated farming system by farmers in Shajapur District, Madhya Pradesh, M.Sc. (Agri.) Thesis, Department of Agricultural Extension, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh; 2018,
19. Philip Antwi-Agyei, Andrew, J., Fougill and Lindsay, C. Stringer. Barriers to climate change adaptation in sub-Saharan Africa: evidence from north east Ghana and systematic literature review. Centre for climate change Economics and Policy. Working paper no. 154. Sustainability research Institute. 2013; pp.52.
20. Rajendra, S.S. Construction of scale for adoption of Paddy production technology, Ph.D. (Agri.) Thesis, Department of Agricultural Extension, N.M. College of Agriculture, Navsari Agricultural University, Navsari; 2013.
21. Ram, K. Perception of Paddy growers about environmental hazards caused through injudicious use of chemicals in Paddy cultivation, M.Sc (Ag) Thesis, Department of Agricultural Extension, B. A. College of Agriculture, Anand Agricultural University, Anand; 2015.
22. Sankara Rao, A., G. Sustainability of Rice farming and Attitude of farmers towards sustainable agriculture in North Coastal Zone of Andhra Pradesh, Ph.D. (Agri.) Thesis, Department of Agricultural Extension, University of Agricultural Sciences, Bengaluru; 2000,
23. Sharma, N. Crop residue management and its impact on Human health, Environment and Agriculture, Ph.D. (Agri.) Thesis, Department of Agricultural Extension, College of Agriculture, Haryana Agricultural University, Hi
24. sar; 2021.
25. Shivamurthy, M. Constraints of the farmers cultivating rain fed Paddy in Eastern dry zone of Karnataka, Mysore Journal of Agricultural Sciences. 2008; 42(1): 163-165.
26. Wakhet. Adoption of organic farming practices in South Western Nigeria, Journal of food agriculture and environment. 2019; 11(2): 403-410.
27. Zhen L and Routray J. K. Operational indicators for measuring agricultural sustainability in developing countries, Environmental Management, 2003; **32**(1): 34-46.

UNDER PEER REVIEW