E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; SP-7(4): 276-280
Received: 09-01-2024
Accepted: 12-02-2024

Siddappa C
University of Agricultural Sciences, Dharwad, Karnataka, India

Angadiand Mouneshwari
University of Agricultural Sciences, Dharwad, Karnataka, India

R Kammar
University of Agricultural Sciences, Dharwad, Karnataka, India

Arjun Sulagitti
University of Agricultural Sciences, Dharwad, Karnataka, India

Corresponding Author:
Siddappa C
University of Agricultural Sciences, Dharwad, Karnataka, India

Exploring the relevance and impact of ITKs on soil and water conservation in Bagalkot district

Siddappa C, Angadiand Mouneshwari, R Kammar and Arjun Sulagitti

DOI: https://doi.org/10.33545/2618060X.2024.v7.i4Sd.622

Abstract
ITK is the sum total knowledge and practices which are based on people's accumulated experiences in dealing with situations and problems in various aspects of life and such knowledge and practices are special to a particular culture. Many of these knowledge and technologies are at par with the modern knowledge and technology system and have been provided the indigenous communities with comfort and self-sufficiency. These traditional knowledge and technologies are location specific, it is 'local', as it is rooted in particular community and situated within broader cultural traditions; it is a set of experiences generated by people living in those communities.

Particularly ITKs pertaining to soil and water conservation are being practiced in various localities in different agro ecosystems. Each set of ITKs are suitable only to the selected area and many a times cannot be replicated. The present study aims at documenting, study the relevance and assess the impact of ITKS in soil and water conservation using snowball sampling technique. A total of 120 farmers were interviewed in 3 villages and 2 talukas spread across Bagalkote district adopting expost-facto research design. A semi structured schedule was prepared with the help of experts in the concerned fields. Participant observation and personal interview method with the help of the schedule was used for data collection. The present study was initiated during the year 2017-2019. Frequency percentages were used to interpret the data. Results revealed that, among the ITKs on soil conservation, preparatory tillage (100%) was performed by all the farmers under the study area followed by earthen bunding and field bunding (66.6%). Vegetative barrier adopted by (33%), stone bunding (30%), while compartmental bunding (8.3%), cover crops (9.6%) and bench terrace (4.16%). Similarly, for ITKs on water conservation measures, farm pond was adopted by 54% of the farmers followed by percolation pond (50%). Rest of the measures like earthen check dam runoff storage structure and groundwater recharge were adopted by the (16.66%) 12.5 percent and 10.83 percent respectively.

Similarly, under the category of ITKs on soil health measures, application of FYM and preparatory tillage were adopted by all the farmers followed by application of sheep and goat manure (80%) and finally the application of tank silt (29.16%) wherever possible. The study explored the rationale of these ITKs as perceived by the farmers. It was revealed that, promotion of infiltration increases the groundwater recharge (60%), biofencing with vegetative barriers (30%), reduction in soil erosion (8%), retaining soil organic matter and reducing the velocity of water run off were the reasons for adopting the ITKS on soil conservation. The rationale for adopting ITKs on soil health management revealed that, application of Farm Yard Manure and sheep and goat manure improves soil fertility, (100%), summer ploughing eradicates weeds and controls pest (100%),application of tank silt improves soil fertility (29%).

The impact of ITKS on yield levels of Kharif and Rabi crops (Greengram and onion as kharif crops sorghum and Bengalgram as Rabi crops) was analyzed and presented in the paper.

Keywords: Relevance, ITKs, soil, water conservation

Introduction
Indigenous Technical Knowledge (ITK) Systems developed over many generations are often energy efficient, at the same time it provides high economic returns to the farmers. In this context, there is a renewed interest in this traditional agro-ecosystem. One of the major lacunae in India agricultural and rural development is its relative failure to recognize the importance of ITK of farm people, as a potent surface of powerful ingredient of a judiciously synthesized technology. Since the ITKs seem to be cheaper, are locally and easily available even in remote areas and have lesser side effects, the use of these ITKs may be encouraged.

Therefore, it becomes important to, study and understand, document and share the rich resources of indigenous knowledge, traditional practices and innovations followed by the farmers.

Particularly ITKs pertaining to soil and water conservation are being practiced in various localities in different agro ecosystems. Each set of ITKs are suitable only to the selected area and many a times cannot be replicated. Bagalkote district in Karnataka state with belonging to Northern dry zone receives annual rainfall of about 530 mm/annum. At present the district has irrigation facility to an extent of about 57 percent, still another 40 percent area is under rainfed agriculture system. The farmers under rainfed system in Bagalkote district especially in Hunagund and Bagalkote still practice the ITKs to conserve soil and harvest rainwater and realized better yields when compared to non-adopter farmers. Hence an attempt was made to document, study the relevance and assess the impact of ITKS in soil and water conservation and their relevance

Methodology

The present study is an innovative effort. Hence, the methodology of documenting indigenous technologies and studying their rationale was evolved during the course of this study and that no existing standard methodology was available for reference. Bagalkote district was purposively selected, based on area receiving low rainfall in northern Karnataka. Bagalkote belongs to Northern Dry zone and receives average 562 mm rainfall yearly. It comprises of six talukas namely, Badami, Bagalkote, Bilagi, Hungund, Jamkhandi, Mudhol. Recently three talukas have been added, thus making a total of nine talukas, of which Hunagund and Bagalkot talukas were purposively selected for the present study with 81601 ha and 29703 ha of dryland respectively. The selection of the villages and farmers was primarily done in consultation with the extension workers of State Department of Agriculture, NGOs and farmers groups.Extension workers worldwide are attracts to progressive farmers like magnets. This is exactly what happened during the present investigation. The extension personnel, particularly those belonging to the State Department of Agriculture, mostly suggested the progressive farmers were the 'old balls ' as Gupta and Patel (1992) [5] call them, ie., the people who think different and who often try old experiments. Apart from purposive selection of such farmers (the old ball) suggested by the extension personnel, some elderly farmers were also selected on random basis who could throw light on the farming practices of pre- green revolution era.

Thus, farmers of such villages where certain indigenous technologies were either being practiced or were developed by farmers themselves and continued to practice, were consulted. During the field investigation farmers were asked to inform such of those villages and farmers that they knew where certain specific farm technologies were evolved or were in practice. As a result of this 'snowball approach' names of farmers spread all over the state were suggested, both by the extension personnel as well as farmers. However, care was taken to visit only the villages and farmers coming under the study area i., e, Bagalkote and Hunagund taluka. The respondents included practitioners of indigenous technologies, present generation evolvers of technologies are also the endorsers of prevalent indigenous technologies. In this way, the villages visited and farmers contacted included those visited randomly as well as purposively. In all 120 farmers were interviewed in 3 villages and 2 talukas spread across Bagalkote district.

A semi structured schedule was prepared and used for data collection. The draft schedule was pre- tested in a non -sample area to locate the ambiguity. Since varied information on indigenous technologies was forthcoming from the farmers, like information on traditional practices, contemporary innovations etc., it was realized that it was not possible to carry a standard schedule to collect all types of information. Hence an exhaustive list of leading question to cover both traditional technologies as well as, contemporary innovations was designed. The emphasis here was on making use of a combination of common sense, a genuine desire to learn from people and eye for detail as Gupta and Patel (1991) [6] put it. After completion of field survey a comprehensive list of technologies identified was prepared. The list was then sorted out, based on the nature of technologies identified by consulting experts.

As and when the respondents mentioned of any indigenous technologies that they had devised, innovated or were practicing since generations, they were requested to elicit the benefits or economic advantages including soil fertility and yield etc. as well as non-economic benefits like the technologies being environmentally friendly, sustainable etc the economic advantages perceived by the farmers were noted down.

Scientific rationale refers to the possible scientific explanation for each of the indigenous technology document i.e., The systemic procedure involved in practicing the technology, the active principles and ingredients responsible for particular elicit etc., the purpose behind studying the rationality was to reinforce farmers ingenuity and experimentation. For establishing scientific rationality, the technologies documented through field survey were sorted out into the technologies that are indigenous but already in vogue among the farmers and scientists alike and those which are seemingly new or unknown to a majority of farmers and scientists. The data was processed and tabulated by using simple statistical tools like frequency and percentages.

Results and Discussion

In the category of ITKs on water conservation measures, farm pond was adopted by 54% of the farmers followed by percolation pond (50%). Rest of the measures like earthen check dam runoff storage structure and groundwater recharge were adopted by the (16.66%) 12.5 percent and 10.83 percent respectively. The results revealed that, indigenous tool rainguage was not adopted by the farmers in the study area.

In the category of ITKs on soil health measures, application of FYM was widely practiced by all the farmers followed by application of sheep and goat manure (80%) the farmers (80%) which was an additional source of nutrients to the soil and finally the application of tank silt (29.16%) was practiced in the farmers' field wherever possible. Preparatory tillage was adopted by 100 percent farmers.

From the village wise data (Table 1), it is clear that among soil conservation measures, field bunding and earthen bunding were the most prevalent practices followed by vegetative barriers. Among the villages, Benakatti has highest number of vegetative barriers followed by Bevoor. Field bunding were also prominently seen in Benakatti followed by Hallur and Hunagund area. Whereas earthen bunding was prominently practiced in Benakatti followed by Hunagund and Hallur farmers. Cover crops, compartment bunding and bench terrace were the least practiced ITKs with 9.6%, 8.3%, 4.1% respectively. Among the ITKs on water conservation measures, farm pond was the single largest measure adopted by 54.16 percent of the farmers followed by percolation pond, earthen checkdam (16.66%), run off storage structure (12.5%) and ground water recharge were the other practices followed by the farmer. Respondent farmers from Hunagund had more number of farm ponds and percolation ponds. In the category of ITKs on soil health management application of FYM was practiced by all the farmers followed by application of sheep and goat manure (50%). Application of tank silt was practiced by 29.16% of the farmers. Preparatory tillage was another practice which was being followed in the study area. %). Results are in line with findings obtained by many researchers (Ingle *et al.*; 2000 and Chittiraichelvan and Raman; 1992, Dekel and Fairs; 1992, Dey; 1992) [8, 2, 3, 4] reveal that ploughing and harrowing across the slopes is an indigenous land preparation, ploughing during April May for maximum retention of rain water and enhancing fertility status of the soil., summer ploughing was proven ITK which controls insect pest and diseases on one hand and decreases soil compaction, increases aeration and infiltration rate on the soil. Hulagur (2006) [7] also found that, through effective soil and moisture – conservation measures, there was remarkable improvement in groundwater table and vegetative treatments and also proved that comprehensive watershed development with people's participation is a feasible proposition.

Table 1: Prevalence of ITKs in the study area

S.N	ITKs	Villages				No of farmers
		Benakatti	Hallur	Hunagund	Bevoor	
I	Soil Conservation Measures					
a	Vegetative barriers	20	5	6	9	40 (33%)
b	Compartmental bunding	6		4		10 (8.3%)
c	Field bunding	35	22	14	9	80(66.6%)
d	Bench terrace	1	1	1	2	5(4.16%)
e	Earthen bunding	31	19	27	13	80(66.6%)
f	Stone bunding	6	7	3	9	28(30%)
g	Cover crops	2	1	1	4	8(9.6%)
II	Water conservation					
a	Runoff storage structures	2	3	9	1	15(12.5%)
b	Rain gauge water management	-	-	--	-	-
C	Farm pond	9	11	41	4	65(54.6%)
d	Percolation pond	13	6	38	3	60(50%)
e	Ground water recharge	2	1	9	1	13(10.83%)
f	Earthen check dam	6	7	5	2	20(16.66%)
III	Soil health Management					
a	Application of tank silt	21	4	6	4	35 (29.16%)
b	Application Farm Yard Manure	30	30	30	30	120 (100%)
c	Application of goat and sheep manure	14	16	19	11	60(50%)
IV	Preparatory Tillage operation	25	30	30	30	120(100%)

The results presented in table 2 reveals the rationality behind the identified ITKS. Since the rationale for adoption of soil and water conservation measures, soil health management were documented based on the perception of the farmers, though the farmers could not quantify the soil eroded, quantity of the water conserved and the exact enhancement of nutritional status of the soil, they were able to judge the benefits of these ITKSs, based in their experience. Retention of sunflower stalks acts as a barrier for runoff and reduces soil loss. It provides more opportunity time for the infiltration of rainwater. It increased the yield of rabi sorghum, sunflower and chickpea to a extent of 30-35 percent (Surkod *et al*. 2003) [12], these authors also mentioned about the use of groundnut shells as cover mulching agent. These researchers also document the advantages of stone bunding. They opine that, there will not be moving of top soil to the bund. Top fertile soil is conserved and breaching of bunds is not observed as in case of earthen bunds. The increase in yield of rabi sorghum chickpea, sunflower and pearl millet was to an extent of 40-45 percent compared with no bunding in the field.

Table 2: Rationale of the ITKs documented as perceived by armers

Sl. No.	Details of ITKs	No of farmers	Rationale as perceived by the farmers
I. ITKS for soil conservation measure			
a	Vegetative barriers	40	Biofencing with trees and bushes protects the field crops from encroachment by human and cattle, also conserves the natural resources i.e., rain water and fertile top soils, fetches additional income through their by-products i.e., food, fodder and fuel wood. Reduce soil loss And Retard and reduce surface runoff by promoting detention and infiltration.
b	Compartmental bunding	10	To conserves the rainwater in situ, reduces runoff, soil and nutrient losses and increases crop yields on sustainable basis. Recharges soil profile uniformly,
c	Field bunding	80	Encourage infiltration (groundwater recharge) and soil moisture.
d	Bench terrace	05	Reduce the velocity of water runoff and thereby soil erosion by breaking the length of the slope that runoff has available.
e	Earthen bunding	80	Effectively store surface run-off and prevent erosion Comparably simple and cheap implementation, simple maintenance, also applicable to fields that are already under cultivation
f	Stone bunding	25	Form a barrier that slows down water runoff, allowing rainwater to seep into the soil and spread more evenly over the land. This slowing down of water runoff helps with building-up a layer of fine soil and manure particles, rich in nutrients.
g	Cover crops	08	Will increase soil organic matter, leading to improvements in soil structure, stability, and increased moisture and nutrient holding capacity for plant growth.

II. Water conservation measures			
a	Runoff storage structures	15	Control water movement over the soil surface,
b	Rain gauge water management	-	As an indicator of receipt of rain, based on which the farmers sow the seeds and then the other farmers in the village go in for sowing.
c	Farm pond	65	Rain water harvesting and use the pond for water storage Farm pond is the most important and promising technology in the watershed management. Farm ponds would help the farmers for on farm water management by using stored water for tacking the drought or dry spells during the season which are common.
d	Percolation pond	60	Ground water recharge and rain water harvesting
e	Ground water recharge	13	Recharging of bore wells and removal of salinity
f	Earthen check dam	20	Prevention of soil erosion and percolation of rainwater
III Soil health management			
a	Application of tank silt	35	To improve the soil fertility and to overcome soil problems
b	Application Farm Yard Manure	120	Improve the soil fertility and increase the humus in soil and water holding capacity and reduces the cost of fertilizers
c	Application of goat and sheep manure	60	Improve the soil fertility and increase the humus in soil and water holding capacity and reduces the cost of fertilizers
d.	Summer ploughing	120	To eradicate the weeds and pest control measure
IV	Preparatory Tillage operation	120	To level the land and prepare for sowing

Kumar *et al*. (1991) [13] concluded that the scientists highly favored the continuous use of 8 out of the 26 traditional practices as such on the basis of their scientific rationality, which relates to inter culturing in kharif, use of local implements for removal of weeds and preparing soil, tying a piece of cloth on plough for adjusting depth of sowing, collecting seed of mustard during noon hours and deep sowing of chickpea. The scientists were undecided about the scientific rationality of another set of 8 traditional practices. The remaining 10 practices were related to unscientific

Major crops cultivated under the study area were onion, Greengram in kharif season, Bengalgram and sorghum in rabi season. The results presented in table 3a and 3b depicts effect of soil and water conservation measure on yield and economics of these crops.

Table 3a: Comparison of Cost of Cultivation of different Kharif crops ITKs (INR)

Sl. No.	Particulars	Onion		Green gram	
		Adopters	Non adopters	Adopters	Non adopters
1	Preparatory Tillage operation	15800	1450	3800	3300
2	Labour charges	32000	28000	5250	5250
3	Operation by machines	400	400	400	400
4	Operation by bullock pair	2100	2100	2100	2100
5	Input cost, seed	4500	4500	282	282
6	Farm Yard Manure	9375	15800	1500	650
7	Tank Silt	11250	-	2000	
8	Sheep and Goat manure	6250	-	1400	
9	Plant protection measures	650	775	550	
10	Miscellaneous	1800	2000	1200	800
11	Total	69905	53225	17982	1782

Table 3b: Economic returns obtained from Kharif crops among the ITK adopted farmers

Particulars	Onion		Green gram	
	Adopters	Non adopters	Adopters	Non adopters
Yield (q/ha)	27.3	17.8	7.35	6.13
Gross return (Rs/ha)	68000	56960	51818	43181
Net return(Rs/ha)	36750	25740	27344	20156
B:C ratio	2.17	1.82	2.1	1.88

Yield levels of green gram in the study area was 7.35 q/ha when compared to non-adopted area (6.13 q/ha). An additional income of Rs. 7188/ha was realized by the farmers practicing ITK with a B:C ratio of 1: 1.21 in the ITK area while 1.18 in non-practicing area. In the onion crop an additional yield of 9.5 tons/ha was realized in study area with monitory benefit of Rs. 11010. The B:C ratio was 1:2.17 in study area while it was 1.82 in non-practicing area. It can be clearly seen that, the difference in the gross return, the difference in the cost of production is almost equivalent inonion, the net return was more.

Table 3c: Economic returns obtained from Rabi crops among the ITK adopted farmers

Particulars	Bengal gram		Sorghum	
	Adopters	Non adopters	Adopters	Non adopters
Yield (q/ha)	19.3	17.5	19.5	15.5
Gross return (Rs/ha)	84920	77000	20740	12400
Net return(Rs/ha)	60669	44570	8880	2625
B:C ratio	3.5	1.72	1.74	1.27

Among rabi crops sorghum (Table 3c) was found to be the main crop, here also an additional yield of 4 q/ha was obtained in ITK practiced area with a B:C ratio of 1.72, while in non practicing area, the yields were less i.e., 15.5 q/ha with a B:C ratio of 1.27. Similarly, in Bengal gram, the total yield was 19.30q/ha in ITK practiced area, while in 17.5 q/ha in non-practicing area, giving an additional yield of 1.8 q/ha. The cultivation of Bengal gram was found to be economical compared to all the crops. It could be because of the reason the per quintal price of the Bengal gram is more when compared other crops. The net return was Rs.60669/ha in ITK practiced area and Rs. 44570/- in non-practicing area with a B:C ratio of 1:3.5 and 1:1.72 respectively.

Table 4: Comparison of Cost of Cultivation of different Rabi crops ITKs (INR)

S. N.	Particulars	Bengal gram		Sorghum	
		Adopters	Nonadopters	Adopters	Nonadopters
1	Preparatory tillage operation	2500	2500	2800	2800
2	Labour charges	4200	3500	5200	5200
3	Operation by machines	1500	1500		
4	Operation by bullock pairs	800	800		
5	Input cost	4100	4100	110	110
6	Irrigation	500		500	
7	Plant protection chemicals	2250	1850	250	200
8	Miscellaneous	600	600	500	500
9	Total	16500	14850	9390	8810

Due to recycling of pond water, 30%-40% of the catchment area gets recharged with moisture and the yield increases between 55% and 90% and the gross return by 55% and 86% with 5 cm and 10 cm of additional water, respectively (Adhikari and Mishra 2009) [1]. A study showed that in a normal year, the supplemental irrigation provided from the stored water from a 10 ha catchment yields net benefits of Rs.76627, Rs, 61215 and Rs. 59210 from 5 cm, 7.5 cm and 10 cm of irrigation water from pond by irrigating 5.2 ha, 3.5 ha and 2.6 ha respectively. Lingappa and Itnal (2006) [9] documented the impact of compartmental bunding on the yield levels of rabi crops. They found that, there was 40 percent, 35 percent, 38 percent and 50 percent increase in yields of Rabi sorghum, sunflower, safflower and chickpea respectively. At central soil and water conservation Research and training Institute, Research Centre Bellary (Karnataka) in deep black soils (vertisols), laying out of fields with compartment bunds increased the rabi sorghum yields by 26% during 1989 and 17% during 2003. The magnitude of increase in grain yield with compartmental bunding was higher (28%) during moderate drought year as compared to only 16% during normal year.

Conclusion

Indigenous technical knowledge is generated by trial and error, experiences and keen observation over a time period in agriculture. This is eco-friendly, cost effective and sustainable with local resources. So, there is need of documentation of these ITKs before valuable knowledge lost forever. The application of ITKs in soil and water management have shown impact on yields, hence these ITKs may be replicated in the areas wit similar ecosystem. There may be some programs from the Govt to promote ITKs in consultation with the learned farmers in order to make effective use of these ITKs and conserve ecosystem.

References

1. Adhikari RN, Mishra PK, Muralidhar W. Dugout farm pond- A potential source of water harvesting in deep black soils in Deccan plateau region. In: Rainwater harvesting and reuse through farm ponds, Proceedings of national workshop cum brainstorming. CRIDA, Hyderabad; c2009. p. 242.
2. Chittarichelvan R, Raman KV. Indigenous knowledge of farmers its uses in extension strategies for rainfed agriculture. In: Technologies for minimizing risk in rainfed agriculture. Singh SP, Prasad C, editors. New Delhi: ISEE, IFAD and ICAR; c1992. p. 185-200.
3. Dekel HH, Fairs AM. Some socio-economic factors affecting wheat and barley production in rainfed areas in Northern Iraq. In: Technologies for minimizing risk; c1992. p. 418-426.
4. Dey R. Changing Scenario of rainfed agriculture a-synthesis papers. In: Technologies for minimizing risk; c1992. p. 351-359.
5. Gupta AK, Patel KK. Survey of farmers innovation in Gujarat, part II. Honey bee. 1992;3(1):9-18.
6. Gupta AK, Patel KK. Experimenting farmers, pastoralists and artisans: Report of survey of local innovations in dry regions of Gujarat. Honey Bee. 1991;2(1):12-23.
7. Hulagur BF. Watershed development–NABARD initiatives. Technical digest. 2006;6:1-4.
8. Ingle PO, Rathod MK, Makeshwar AD. A report on documentation of technical knowledge submitted to Directorate of Extension, Ministry of Agriculture and co-operation, GOI, New Delhi; c2000.
9. Lingappa S, Itnal CJ. Bar nirvana mattuparyayabeleyojene. Dharwad: University of Agricultural Sciences; c2006.
10. Patil SL, Nalatwadmath SK. Compartmental bunding for in situ rainwater conservation. Bellary, Karnataka, India: Central Soil and Water Conservation Research and Training Institute, Research Centre; c2009.
11. Padaria RN, Singh RP. Risk adjustment and traditional wisdom in dryland farming. Indian Journal of Extension Education. 1990;26(3 and 4):1-7.
12. Surkod VS, Guled MB, Hiremath KA, Kabadagi GB. Indigenous techniques of soil and moisture conservation and runoff management. Dharwad: University of Agricultural Sciences; c2003.
13. Kumar K, Nath R, Wyant GM. Treatment of chronic pain by epidural spinal cord stimulation: a 10-year experience. Journal of neurosurgery. 1991 Sep 1;75(3):402-407.