ORIGINAL RESEARCH PAPER

Economics

IMPACT OF DRY LAND FARMING ON AGRICULTURE PRODUCTION IN KARNATAKA: AN EMPIRICAL ANALYSIS

KEY WORDS: Dry Land Farming, Geographical Area, and Growth of Dry Land Zones.

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ABSTRACT

Dry land farming is one of the key roles in the agriculture development and its impact of the agricultural activities in India as well as Karnataka state. In India 60% of the total cultivated area is rain fed. About 40% of the rural population and 60% of cattle live in dry lands. In the total farm production of the country 42 per cent of food grain, 75% of oilseeds, more than 90 per cent of di-cot grams, sorghum, groundnut and 70% of cotton come from dry land and rain fed farming. Even 61.7% paddy is also being produced under rain fed condition. This research article analyzed that the dry land farming and agriculture production in Karnataka as well as dry land zones-wise total of geographical area, gross cropped area, net cropped area, gross irrigated area in Karnataka in 2007-08. The main focus of the research study is to analyze the dynamics of dry land farming and its impact on agriculture production in Karnataka.

INTRODUCTION

Dryland farming is practiced in the more arid and desert-like areas of the country, including northwest and central India. Crops such as gram jowar, bajra, and peas are grown in these conditions. Dry and semi-dry areas with rainfall between 750 – 1150 mm and lower moisture availability for crops are chosen for such cultivation in India. Karnataka has the second largest area under rain-fed agriculture after Rajasthan in the country. Nearly, 55% of total food grain production and 74% of oilseeds production come from rain-fed agriculture in Karnataka. Therefore, rain-fed agriculture plays an important role in total food grain production in the state. Further, the rain-fed agriculture has substantial untapped potential, this can be brought to use by increasing the crop yields in the dry land areas through the adoption of proper dry-land production technologies.

Objectives of the Study

1. To study the overview of dry land farming in India and Karnataka.
2. To analyse the dry land farming and its impact on agriculture production in Karnataka.

Research Methodology

The present research study was an attempt that the dry land farming and its impact on agriculture production in Karnataka. The research study is a mainly based on secondary data information. It has been collected from the annual reports of Department of Agriculture and Welfare, Census of Agriculture in India and Karnataka (2011), Annual Season and Crop of Agriculture Department, Directorate Economics and Statistics, Bangalore,

Dryland Contribute to Indian Economy

In India 60 per cent of the total cultivated area is rain fed. About 40 per cent of the rural population and 60 per cent of cattle live in dry lands. In the total farm production of the country 42 per cent of food grain, 75 per cent of oilseeds, more than 90 per cent of di-cot grams, sorghum, groundnut and 70 per cent of cotton come from dry land and rain fed farming. Even 61.7 per cent paddy is also being produced under rain fed condition. This means we have to achieve more in dry land farming to enhance food production of the country. Irrigated crop can yield 3 times more than the dry land crop. But there is a limit for the expansion of the irrigated area. Most of the high yielding varieties and technologies are developed for irrigated farming. But now we are compelled to give more priority for dry land farming for sustainable farm production.

Categorization of Dry Land Farming in India

Dry lands in rain shadow areas after heavy rainfall regions. In India 84 districts are totally rain fed. Karnataka state has 75 to 80% cultivated area under rain fed farming. Rajasthan stands first in the country and Karnataka in 2nd position in dry land area. Major portion of high rainfall area also depends on rain water for crop production. Cultivation in these areas is categorized in to dry farming, dry land farming and rain fed farming depending on the amount of rainfall received. Farming in the areas with less than 750 mm average rainfall is dry farming. Drought in the mid cropping season, failure of the crop etc. are very common here. Cropping duration is hardly 75 days. Farming is not possible without the conservation of rain water. Crop production in the areas with 750 mm to 1150 mm rainfall is dry land farming. Cropping period is between 75 to 120 days. Farmer will succeed in one crop with rain water conservation. Crop production in humid regions with more than 1150 mm rainfall is rain fed farming. Cropping duration is more than 120 days. There is no shortage of water for one crop. Sometimes two crops are also possible.

Soil erosion is a severe problem in dry lands. Everything is uncertain due to deficient and erratic rain. Evaporation and transpiration rate are more due to high temperature. Many times, there will be acute shortage for drinking water also. Normally the dry land will be less fertile and saline sometimes. Farming here is like a gambling with nature. Only the drought tolerant crops like oilseeds, di-cot grams, sorghum, foxtail millet, kodo millet and other minor millets are successful here. Organic matter content of the soil is less. Large area, mono-cropping, very low yield and income, poor economic condition of the farmer etc. are very common in dry lands. All these lead to many ecological, health and social problems. Sustainable farming for better yield and income can improve overall situation. To achieve this, it is advisable to go for integrated farming with soil and water conservation, organic farming, agro-forestry, keeping livestock and farm based subsidiary activities.

Cultural Methods for Drylands

Deep summer ploughing is practiced after the harvest of Rabi crop. This is useful to kill weeds, pathogens and pupae of insects and also to conserve summer rainwater. Deep ploughing up to 1 foot is good in deep black soils. This helps for deep rooted crops like cotton, red gram etc. to spread their roots to deeper layers. In shallow and sandy soils ploughing up to 4 to 5 inches is enough. Rainwater percolation increases with the depth of ploughing. Repeated inter-cultivation is done between crop rows to pulverize the soil surface. Early sowing is advised in dry land. Broadcasting of seeds is not good. The seed may not germinate due to lack of moisture. Sow the seeds with seed drills to 1 to 2-inch depth depending on the size of the seed. Then cover the soil and compact it by running wooden plank. Seed germinates with available soil moisture. Use 25 per cent more seed than the normal seed rate.

Fertilizers:

Generally dry land is deficient in nitrogen and phosphorus. Potash will be at medium to high range. Use of fertilizers is very less in dry land farming compared to irrigated crops. Broadcasting of fertilizers will lead to wastage due to less soil moisture content. Put fertilizers in sub-soils with the help of fertilizer drill. This helps for better absorption and good crop stand. Foliar spraying of nutrients is also effective. This minimizes the wastage of costly fertilizers.

Organic Manures:
Application of organic manures in dry land farming has many advantages. It improves the percolation of rainwater and water holding capacity of the soil. Soil temperature remains under control. Organic matter improves the soil structure which helps for better root growth and proliferation. All these contribute to better plant growth and yield. Green manuring and use of bio-fertilizers is also recommended in dry land farming. Try to include leguminous crops as a mixed crop or in the crop rotation cycle which improves soil fertility. Add all available crop residues back to the soil as organic matter.

Crop and Variety Selection:
Now let us understand the criteria and methodology for crop and variety selection for dry land farming. Choose drought resistant or at least tolerant crops and varieties. Short and medium duration crops will escape drought at the end of the season. Fast growth in the early stage itself, comfortable yield even in difficult condition, resistance for pest and diseases, low water requirement etc. are the preferred characteristics of dry land crops. The roots should penetrate deep and branch at deeper layers of the soil. Sorghum, finger millet, wheat, minor millets like foxtail millet, pearl millet, proso millet, kodo millet, little millet, di-cot grams and oilseeds are the common successful crops in dry lands. Most of the popular high yielding varieties and hybrids are developed for irrigated farming. Hence it is better to go for local crops and varieties or those specially developed for dry land farming.

Cropping Plans for Drylands
Crop planning depends on the amount of rainfall and its distribution, type and depth of soil.

Based on Rainfall
Mono-cropping is better in the regions with less than 500 mm rainfall. Groundnut, sorghum, finger millet, minor millets etc. are preferred here. Multiple and inter cropping systems are followed in the regions with 600 to 850 mm rainfall. Here one or the other crop in the combination gives comfortable yield. Few examples of such crop plans are here sorghum-red gram-6-8:1, sorghum-cowpea-2:1, cotton-black gram-1:2, groundnut-redgram-6-8:1, groundnut-caster-6-8:1, Bengal gram-coriender-4:1, maize-cowpea-2:1, finger millet-cowpea-red gram-6:1:1, groundnut-red gram-11:1, sorghum-red gram-2:1, ground-caster-4:1, Bengal gram-caster-3:1, finger millet-red gram-8:1 and so on.

Based on Soil Depth
In very shallow soils with 2 to 3 inch depth better to grow fodder grasses. For soils with 6 to 9 inch depth Dolichos (Hebbal Avare), caster, fodder grasses, agro-forestry species, horticultural crops, pearl millet, lentil etc. are recommended. For soils with half to one and half feet depth minor millets, red gram, sunflower, groundnut, caster etc. are preferred. For soils with 2 to 3 feet depth green gram or black gram in Kharif season and sorghum or safflower in Rabi season are recommended. In deep soils one can grow most of the dry land crops.

Based on Onset of Monsoon
This method of the rain starts in May itself, go for sesamum-red gram-10:2 or 3:1. If the monsoon starts in May last week to June first week put red gram-maize-1:1, red gram-short duration cowpea-1:1, sorghum-red gram-2:1, caster-linseed or finger millet-3:1 etc. If the rain starts by June 2nd week to July months go for finger millet-red gram-8:2, groundnut-red gram-8:2, groundnut-caster-8:1, finger millet-Dolichos-8:1 or 10:1 etc. If the rain delays further put finger millet-soya bean-4:1, horse gram-linseed-8:2 etc.

Dry Land Farming in Karnataka
Dry land/ Rainfed Agriculture The first challenge posing the agriculture sector in Karnataka is to mainstream the vast drought prone/ rainfed area. At present the undue share of this area is the stumbling block for the state in the race to move onto higher growth path. The large presence of rainfed regions is also compounded by frequent climatic aberrations and not so frequent but devastating floods. Failure of technology to meet these challenges resulted in low average productivity and consequently low income. Therefore, meeting this challenge upfront is the first priority in the coming decade. The vision is thus set to bring the rainfed areas under the new growth initiatives. Rainfed/ dryland areas confront harsh environment and economic hardship. The basic problem of dryland areas is one of a vicious cycle that starts with low water availability, degradation of natural resource base because of poor management which ultimately results in low productivity. This, in turn, leads to over-exploitation of the existing natural resources and causes further degradation. One of the major problems that have to be overcome in this regard as said earlier is the frequent occurrence of droughts and the infrequent but devastating floods in some of the regions.

Dry Land Farming and Its Impact on Agriculture Sector in Karnataka
Five out of ten agro-climatic zones in Karnataka are dry zones. Nearly 55 per cent of food grains and 75 per cent of oil seeds are contributed by rain-fed areas. The analysis of rainfall pattern of the state indicates that 3 to 4 years in every decade face severe drought; sometimes drought occurs in consecutive years also. A wide majority of dry land areas receive an annual average rainfall of 450 to 700 mm, which is highly erratic and unevenly distributed during the cropping seasons. Thirteen years out of the last 16 years have been declared drought-years in the state. The land resources of Karnataka, especially the dry drought prone areas, have been poorly managed by the resource-starved agriculture farmers of the state. Soil loss owing to erosion joined with reduced water resources has led to a situation of rapid deterioration of soil fertility, declining/stagnating crop yields, depletion of underground water sources, deforestation, denudation, destruction of natural pasture and diminishing biomass production.

Table-1 Agro-Dry Land Zones of Karnataka

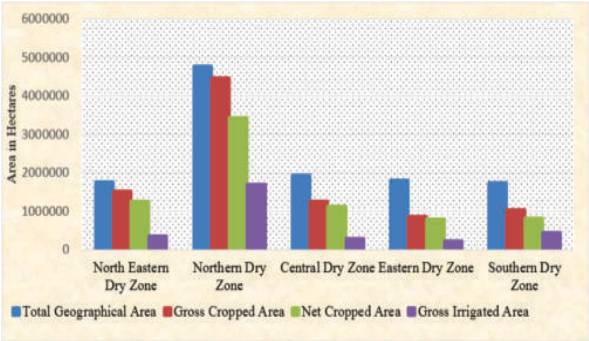
Name of the Zone	District	Name of the Taluks
North Eastern Dry Zone	Gulbarga (5) Yadgir (3) & Raichur (3)	Afzalpur, Chitapur, Gulbarga, Jewargi, Sedum, Shahapur, Yadgir, Shorapur, Raichur, Deodurga, Manvi.
Northern Dry Zone	Koppal (4), Gadag (4), Dharwad (1), Belgaum (5), Bijapur (5), Bagalkot (6), Bellary (7), Davangere (1), Raichur (2)	Gangavathi, Koppal, Kushtagi, Lingasugur, Sindhanur, Yelburga, Badami, Bagalkote, Bagewadi, Bilgi, Bijapur, Hungund, Indi, Jamkhandi, Mudhol, Muddebihal, Sindhagi, Bellary, Hagaribommanahalli, Harapanahalli, Hadagali, Hospet, Kudligi, Sandur, Siruguppa, Ron, Navalgund, Naragund, Gadag, Mundargi, Ramdurga, Gokak, Raibag, Soundatti, Athani.

Central Dry Zone	Chitradurga (6), Davangere (3), Tumkur (6), Chickmagalur (1), Hassan (1)	Challakere, Chitradurga, Davanagere, Harihara, Hiriyur, Hosadurga, Holalkere, Jagalur, Molkalmuru, Arasikere, Kadur, Madhugiri, Pavagada, Koratagere, C.N.Halli, Sira, Tiptur.
Eastern Dry Zone	Bangalore Rural (4), Ramanagar (4) Bangalore Urban (3), Kolar (5), Chikkaballpur (6) Tumkur (2).	Gubbi, Tumkur, Anekal, Bangalore South, Bangalore North, Channapatna, Devanahalli, Doddabalapur, Hosakote, Kankapura, Magadi, Nelmangala, Ramanagar, Bagepalli, Bangarpet, Chikkabalapur, Chintamani, Gudibanda, Gowribidanur, Kolar, Malur, Mulbagal, Sidalaghatta, Srinivasapura.
Southern Dry Zone	Mysore (4), Chamarajnagar(4), Mandya (7), Tumkur (2), Hassan (2).	K.R.Nagar, T.Narasipur, Mysore, Kollegal, Nanjangud, Turuvekere, Kunigal, Nagamangala, Srirangapatna, Malavalli, Maddur, Mandya, Pandavapura, K.R.Pet, Channarayapatna, Hassan, Chamarajanagar, Yelandur, Gundlupet.

Important several WDPs implemented in the state have been quite successful and considering their importance, the state has created a dedicated department from 2000-01, namely, the Watershed Development Department exclusively for giving undivided attention to all projects of watershed development under various schemes. The cumulative progress achieved under watershed development programs at the end of the Tenth Five-Year Plan i.e., 2006-07 under various schemes was 47.04 lakh hectares. As per available data, 7.5 lakh hectares of additional area were covered under watershed activities during the XI plan period with a cumulative total of 54.59 lakh hectares in 2011-12. Area covered under watershed was 4.01 and 4.67 lakh hectares during 2012-13 and 2013-14 respectively. However, the pace of watershed activities slowed down in the following years. The area covered under watershed activities was 2.22 lakh hectares during 2014-15 with a cumulative total of 65.49 lakh hectares. The details of the agriculture zone-wise total geographical area, gross cropped area, net cropped area and gross irrigates area in Karnataka in 2007-08 are presented in Table-2.

Table-2 Agriculture Zone-wise total Geographical Area, Gross Cropped Area, Net Cropped Area and Gross Irrigated Area in Karnataka 2007-08 (Area in Hectares)

Name of the Zone	Total Geographical Area	% of Geographical Area	Gross Cropped Area	Net Cropped Area	% of NCA to Geo. Area	Gross Irrigated Area	% of GIA to GCA
North Eastern Dry Zone	1762604	14.64	1526720	1251861	16.85	348257	11.64
Northern Dry Zone	4783642	39.74	4478665	3432394	46.20	170351 0	56.93
Central Dry Zone	1943830	16.15	1254076	1129389	15.20	282459	9.44
Eastern Dry Zone	1808217	15.02	861375	802088	10.80	222375	7.43
Southern Dry Zone	1739430	14.45	1032601	813227	10.95	435546	14.56
Total	12037723	100.00	9153437	7428959	100.00	2992147	100.00
Mean	2407544.6	1830687.4		1485791.8		598429.4	



Graph - 1 Agriculture Zone-wise Total Geographical Area, Gross Cropped Area, Net Cropped Area and Gross Irrigated Area in Karnataka 2007-08

Table-2 and Graph-1 shows the agriculture zone-wise total geographical area, gross cropped area, net cropped area and gross irrigates area in Karnataka in 2007-08. It seen from that the above table, Northern Dry Zone has the highest total geographical area is 4783642; Central Dry Zone has the second highest total of geographical area is 1943830. This is followed by the total of geographical areas is in Eastern Dry Zone (1808217), North Eastern Dry Zone (1762604), and the Southern Dry Zone (1739430). The Gross cropped area is the highest of the Northern Dry Zone (4478665), the second position of the North Eastern Dry Zone is 1526720.

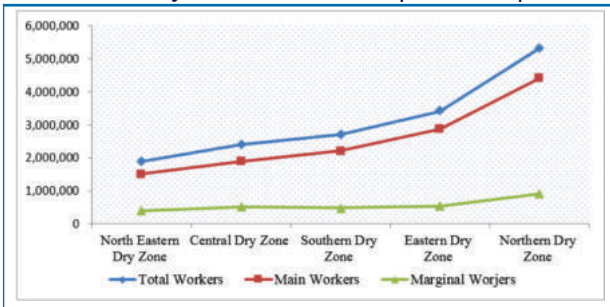
This is followed by the gross cropped area is in Central Dry Zone (1254076), Southern Dry Zone (1032601) and last position is the Eastern Dry Zone (861375). The Net cropped area is the highest of the Northern Dry Zone (3432394), the second position of the North Eastern Dry Zone is 1251861.

This is followed by the net cropped area is in Central Dry Zone (1129389), Southern Dry Zone (813227) and last position is the Eastern Dry Zone (802088). Northern Dry Zone has the highest gross irrigated area is 1703510, North Eastern Dry Zone has the second highest total of gross irrigated area is 348257. This is followed by the gross irrigated areas is in Southern Dry Zone (435546), Central Dry Zone (282459), and the Eastern Dry Zone (222375).

Table- 3 Working Population by Dryland Zones in Karnataka

Name of the Zones	Total workers	Main workers	Marginal workers
North Eastern Dry Zone	1,895,752 (12.06%)	1,504,425 (11.68%)	391,327 (13.77%)
Central Dry Zone	2,406,189 (15.30%)	1,895,533 (14.71%)	510,656 (17.97%)
Southern Dry Zone	2,698,957 (17.16%)	2,210,610 (17.16%)	488,347 (17.18%)
Eastern Dry Zone	3,407,181 (21.67%)	2,867,802 (22.26%)	539,379 (18.98%)
Northern Dry Zone	5,316,867 (33.81%)	4,404,555 (34.19%)	912,312 (32.10%)
Total	15,724,946 (100.00%)	12,882,925 (100.00%)	2,842,021 (100.00%)
Average	3,144,989	2,576,585	568,404

Source: Census of India, 2011.



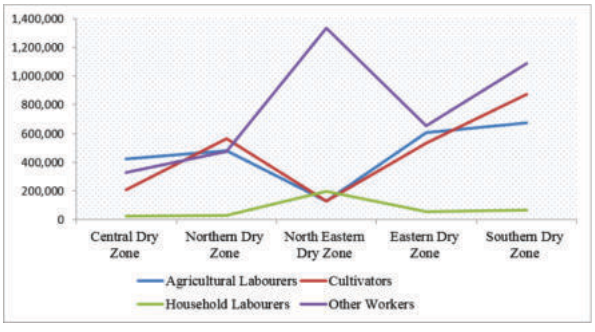
Graph - 2 Working Population by Dryland Zones in Karnataka

The above Table-3 and Graph-2 indicate that the working population by zone-wise in Karnataka. It is clear from the above table; the Northern Dry Zone has the highest working population of 5,316,867 among the 4,404,555 main workers, and 912,312 people who are the marginal workers. The Eastern dry zone is the next highest working population of 3,407,181 among the 2,867,802 main workers, and 539,379 people who are the marginal workers. The Southern dry zone is the third highest working population of 3,407,181 among the 2,210,610 main workers, and 488,347 people who are the marginal workers. The fourth highest position of the Central dry zone has working population of 2,406,189 among the 1,895,533 main workers, and 510,656 people who are the marginal workers. The North Eastern dry zone has fifth position of the working population of 1,895,752 among the 1,504,425 main workers and 391,327 people who are the marginal workers as per Census of India 2011.

Table - 4 Dryland Zones-wise Working Population by Categories in Karnataka

Zones	Agricultural Labourers	Cultivators	Household Labourers	Other Workers
Central Dry Zone	424,873 (18.37%)	205,677 (8.93%)	23,540 (6.29%)	328,627 (8.48%)
Northern Dry Zone	477,610 (20.65%)	561,408 (24.37%)	32,006 (8.55%)	475,461 (12.26%)
North Eastern Dry Zone	131,462 (5.68%)	128,847 (5.59%)	199,762 (53.38%)	1,332,971 (34.38%)
Eastern Dry Zone	605,401 (26.17%)	533,899 (23.17%)	54,734 (14.63%)	652,573 (16.83%)
Southern Dry Zone	673,633 (29.12%)	874,020 (37.94%)	64,197 (17.15%)	1,087,107 (28.04%)
Total	2,312,979 (100.00%)	2,303,851 (100.00%)	374,239 (100.00%)	3,876,739 (100.00%)
Average	462,596	460,770	74,848	775,348

Source: Census of India, 2011.



Graph - 3 Dryland Zones-wise Working Population by Categories in Karnataka

Table-4 and Graph-3 showed tat the dryland zones-wise working population by different categories in Karnataka. The working population is categorized largely as agricultural labourers, cultivators, household labourers and other workers. The Northern Dry Zone has the highest number of taluks with the largest of working population among the workers, 2,312,979 are the total agricultural labourers, 2,303,851 are the total cultivators, 374,239 are the total household labourers and 3,876,739 are the total other workers dependents on the working population. The Central Dry Zone, Northeastern Dry Zone and the Eastern Dry Zone illustrations the highest number of agricultural labourers. The working population the state depends on the availability of agricultural lands, irrigation facilities, local industries and household businesses in the respective dryland agriculture production zones. The working population by categories in different dryland zones is presented in Table-4 and Graph-3.

CONCLUSION

It can be concluded that the above analyzed that the dry land farming and its impact on the total of geographical area, gross cropped area, net cropped area and gross irrigates area in Karnataka in 2007-08. However, the zone-wise working population in the dry land farming and working population by categories in the dry land farming in the State. Karnataka has large extents of lands under dry farming with great potential to grow high value but less water demanding major crops of agriculture. In fact, dry lands are the hope of the future for feeding the fast-increasing population. To improve the economic conditions of the farmers in the dry tracts and their nutrition and health standards it is necessary to encourage dry land farming and its impact on agriculture and allied activities. It is suggesting that the dry land farming better agronomic practices need to be developed and advocated for these agricultural major crops. The technology package involves identification of appropriate crop species and varieties suitable to local soil and rainfall pattern.

REFERENCES

1. Angles, S., Chinnadurai, M., & Sundar, A. (2011). Awareness on impact of climate change on dryland agriculture and coping mechanisms of dryland farmers. Indian Journal of Agricultural Economics, 66(902-2016-67307).
2. Chandrakanth, M. G., Priyanka, C. N., Mamatha, P., & Patil, K. K. (2013). Economic benefits from micro irrigation for dry land crops in Karnataka. Indian Journal of Agricultural Economics, 68(902-2016-66842), 326-338.
3. Chandrashekhar, H and Venugopal T.N., (1995), Drought Assessment and Response System Chitradurga district, Karnataka Summary, P. 94.
4. Census of 2011, India and Karnataka.
5. Dupdal, R., Patil, B. L., & Naik, B. S. (2021). Perceptions and adaptation strategies to changing climate: evidence from farmers of northern dry zone of Karnataka. Indian Journal of Extension Education, 57(3), 60-64.
6. Government of India (2017-18), Department of Agriculture and Welfare.
7. Government of Karnataka (2007-08), Annual Report of Directorate of Economics and Statistics of Karnataka.
8. Government of Karnataka (2020-21), Economic Survey of Karnataka, Planning, Progrmme Monitoring and Statistics Department, Bangalore.
9. Naidu, L.G.K, S.Srinivas, Rajendra Hegde and Devaraja M., (2006), Assessment of Length of Growing Period (LGP) in Agro-climatic zones of Karnataka for Crop Planning. Mysore J. Agric. Sci., 40 (4):522-533.
10. Naidu, L.G.K and Srinivas S, (2005), Length of growing period as criteria fo identifying different drought types in Karnataka. Indian. J. Agric. Sciences. 75 (9):614-615.
11. Julich, S., (2015), Development of a composite index with quantitative indicators for drought disaster risk analysis at the micro level, Hum. Ecol. Risk. Assess. International Journal. 21(1):37-66.
12. Palanisami, K., Haileslassie, A., Kakumanu, K. R., Ranganathan, C. R., Wani, S. P., Craufurd, P., & Shalander, K. (2015). Climate Change, Gender and Adaptation Strategies in Dryland Systems of South Asia: A Household Level Analysis in Andhra Pradesh, Karnataka and Rajasthan States of India; Research Report No. 65.
13. Singh, K. (1991). Dryland watershed development and management: A case study in Karnataka. Indian Journal of Agricultural Economics, 46(902-2018-2824), 121-131.