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# A STUDY ON IMPACT OF DROUGHT ON FARM HOUSEHOLDS IN RAMANAD DISTRICT, TAMILNADU

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## ABSTRACT

*A drought is a period of below-average precipitation in a given region, resulting in prolonged shortages in its water supply, whether atmospheric, surface water or ground water. A drought can last for months or years, or may be declared after as few as 15 days. It can have a substantial impact on the ecosystem and agriculture of the affected region and harm to the local economy. This paper deals with impact of drought on Farm Households in Ramanad District, Tamilnadu. It outlines the farmers' rating on causes of drought, impact of drought on farm economy, drought mitigation measures and drought coping mechanism. This paper concludes with some intresting findings.*

**KEYWORDS:** *water supply, drought, natural disaster, farm economy, hydroelectricity*

## INTRODUCTION

Monsoon drought is natural disaster known to India from time immemorial as the rain in some area of India underperforms. The Indian sub continent experiences large-scale drought in some part or the other, almost every year. Drought occurs in nearly all climatic zones of the world at one time or other, but this creeping phenomenon mostly affects tropics and adjoining regions. As a disaster, its experience feels only after it has occurred. Drought exerts profound influence over agriculture, hydrology, tourism, transport, water supply, hydroelectricity, etc. There is hardly any decade when the drought not occurred in India at least in two years. Hence, drought a normal feature of Indian climate and its recurrence is inevitable. It is part of climate variability. Unlike other weather related natural disasters drought creeps in slowly and passively. Naturally, the study of monsoon features and consequent drought has attracted the attention of Indian meteorologists' since long time.

## DROUGHT DEFINITIONS

Drought is an occasion when the rainfall for a week is half of the normal or less, when the normal weekly rainfall is 5 mm or more. Agricultural drought is a period of four such consecutive weeks in the period from middle of October or six consecutive weeks during rest of the year. Seasonal drought occurs when the actual seasonal rainfall is deficient by more than twice the mean deviation (Government of India Ministry of agriculture and irrigation, 1976).[1] This is description of drought stated in the report of National commission of Agriculture of 1976. It could be noted that some reseachers made use of aridity index of Thornthwaite and drought years were classified as moderate, large severe or disastrous according to the departure of the yearly aridity index from the climatic normal values.

Drought is a period of drier-than-normal conditions that results in water-related problems. Definitions of drought varied widely with area of interest. Palmer (USA) defines drought as an interval of time, generally the order of months or year in duration, during which the actual moisture supply at given place consistently falls short of the climatically expected moisture supply. The US weather bureau defines drought

as period of dry weather of sufficient length and severity to cause at least partial crop failure. Thornthwaite (1948)[2] defines drought as condition in which the amount of water needed for transpiration and direct evaporation exceeds the amount available in soil. Warrick defined drought as a lack of rainfall so large and so long continued to adversely affect all established human activities of the region. Different countries have, however defined drought as per their rainfall pattern. The British rainfall organization in UK defines "absolute drought" when at least 15 consecutive days none of which receive at least 0.25 mm of rainfall and partial drought when at least 29 days during which mean rainfall does not exceed 0.25 mm per day (Shewale M.P. and Shravan Kumar, 2005).[3] In U.S.A. According to Conard (1944)[4] a period of consecutive 20 days or more without 6.4 mm precipitation in 24 hours during season March to September is considered as drought situation. In Australia according to Gibbs and Maher (1967)[5], the rainfall is the best single index of drought and use of rainfall declines demonstrate temporal and spatial distribution. In USSR drought is defined as period of ten days with a total rainfall not exceeding 5mm. According to Ramdas (1948)[6]"drought is an occasion when the actual rainfall fell short of the normal by more than twice the mean deviation." However, from practical standpoint, drought may be regarded as a period of abnormal dry weather sufficiently prolonged for lack of water to cause serious hydrological imbalance in the affected area. The Indian meteorological Department defines drought in any area when the rainfall deficiency in that area is more or equal to 26 per cent of long term normal. It is further classified in to moderate and severe drought depending upon the rainfall. A period of drought is defined as a year or season in which the total rainfall is less than 75% of the normal. It may further be classified as a year or season of 'moderate drought' if rainfall deficit is between 26 percent and 50 percent and a year or season of 'severe drought' when it is more than 50 percent. When during a long period of years, drought as defined above, occur on at least 20 percent of the years over an area that may be classified as a 'drought prone area.' If the frequency is, 40 percent or more then area may be termed as 'chronically drought area. For the country as whole, the area-weighted rainfall having normal of 88 cm, also called Indian summer monsoon rainfall is considered. When the rainfall deficiency exceeds 10% and when area under drought exceeds 20% of the total area of the plains in the country which is 32, 87 787 sq. km such situation is considered as drought for country as whole.

The definition of drought remained inexact and based on inference for over 5000 years of human history until the means of quantifying it became available in the late 19th century when reliable observation of rainfall began.

Drought may be broadly classified into the following three types:

(1) Meteorological drought: It is a situation when there is significant more than 25 per cent decrease from normal precipitation over an area.

(2) Hydrological drought: meteorological drought, if prolonged, results in hydrological Drought marked depletion of surface water and consequent drying of reservoirs, lakes, Steams, and rivers, cessation of spring flows and fall in ground water levels. Hydrological drought may be reflected in depleted snowmelt due to poor snow-fall in an Earlier season and this may result in curtailment of power generation and affect industry As well as agriculture.

(3) Agricultural drought: It occurs when soil moisture and rainfall are inadequate during growing season to support healthy crop maturity and cause extreme crop growth to maturity and cause extreme crop stress and wilt.

(4) Economic drought: When deficit precipitation affects the normal economic growth of the country it results into economic drought.

## METHODS AND MATERIALS

This study deals with drought disaster in Ramanad District in Tamilnadu. In this study, the indicators relating to drought coping mechanism, causes of drought, effects of drought and impact of drought are identified under the exploratory research framework. The identified indicators relating to drought coping mechanism, causes of drought, effects of drought and impact of drought are cross tabulated with the farm holding size of the farmer respondents and thereby it gives analytical orientation to the study. Thus this study is partly exploratory in nature and partly analytical in nature.

The researcher has selected the Ramanad district in Tamilnadu in the first stage of sampling. From this district, the researcher has selected the Ramanad taluk. From this taluk five drought prone villages are selected as sample. From each village 25 farmers are selected as sample under simple random sampling method.

The relevant primary data have been collected from the farmers of Ramanad taluk of Ramanad district in Tamilnadu State. The data from the farm households

have been collected to make an extensive analysis of the impact of drought. The researcher made use of interview scheduled method to collect the data from the respondents.

The collected data have been classified and tabulated with the help of computed programming; cross tabulation is done by putting independent variable of farm size with dependent variables of impact of drought on farm households. In order to study the impact of drought the researcher has adopted 5 point rating scale. It includes very high level 5 point rating score, high level 4 point rating score, moderate level 3 point rating score, low level 2 point rating score and not at all 1 point rating score.

To study the variation due to impacts of drought and variation due to independent variable, the researcher has applied the anova two way test. To analyze the two group mean sample, the researcher has applied the't' test. The general data interpretation is dome with the help of average analysis.

## RESULTS AND DISCUSSION

This section deals with farmers' rating on causes of drought, impact of drought, drought coping mechanism and drought mitigation measures.

### Causes of Drought:-

This section deals with respondents' rating on indicators of drought. It can be assessed with the help of 23 factors on a 5 point rating scale. These include reduction in rainfall, dust storms, El Nino phenomenon, lack of rainfall, failure to store surplus rainwater during rainy season, soil erosion, diminishing crop growth, deforestation, late monsoon and below average rainfall, over grazing, high level plant transpiration, famine, period of excessive heat, monsoon failure, global warming, low level precipitation, climate change, late onset or early withdrawal of monsoon, low moisture, geographical location, lack of vegetative cover, storm and prolonged breaks in monsoon.

**Table 1 Farm Wise Respondents' Rating on indicators of Drought**

| Variables | Marginal | Small | Medium | Large | Mean |
|---|---|---|---|---|---|
| Low moisture | 1.95 | 2.12 | 2.33 | 2.56 | 2.24 |
| Low level precipitation | 2.22 | 2.39 | 2.60 | 2.83 | 2.51 |
| High level plant transpiration | 2.64 | 2.90 | 3.19 | 3.59 | 3.07 |
| Monsoon failure | 2.38 | 2.67 | 2.86 | 3.06 | 2.74 |
| Failure to store surplus rainwater during rainy season | 3.26 | 3.80 | 4.00 | 4.07 | 3.78 |
| Deforestation | 2.94 | 3.19 | 3.51 | 3.94 | 3.39 |
| Lack of vegetative cover | 1.87 | 2.02 | 2.15 | 2.43 | 2.12 |
| El Nino phenomenon | 3.56 | 4.03 | 4.12 | 4.18 | 3.97 |
| Climate change | 2.17 | 2.34 | 2.55 | 2.78 | 2.46 |
| Dust storms | 3.82 | 4.05 | 4.13 | 4.19 | 4.05 |
| Diminishing crop growth | 3.05 | 3.30 | 3.92 | 4.05 | 3.50 |
| Lack of rainfall | 3.32 | 3.98 | 4.07 | 4.17 | 3.89 |
| Period of excessive heat | 2.56 | 2.82 | 3.01 | 3.21 | 2.89 |
| Over grazing | 2.73 | 2.98 | 3.27 | 3.67 | 3.15 |
| Soil erosion | 2.98 | 3.37 | 4.01 | 4.15 | 3.63 |
| Storm | 1.83 | 1.92 | 2.05 | 2.27 | 2.02 |
| Global warming | 2.32 | 2.61 | 2.80 | 3.00 | 2.68 |
| Geographical location | 1.94 | 2.07 | 2.24 | 2.50 | 2.19 |
| Reduction in rainfall | 3.99 | 4.10 | 4.18 | 4.19 | 4.12 |
| Late monsoon and below average rainfall | 2.83 | 3.08 | 3.40 | 3.83 | 3.28 |
| Late onset or early withdrawal of monsoon | 2.03 | 2.20 | 2.41 | 2.64 | 2.32 |
| Prolonged breaks in monsoon | 1.82 | 1.86 | 1.98 | 2.13 | 1.95 |
| Famine | 2.57 | 2.83 | 3.12 | 3.52 | 3.00 |
| Average | 2.64 | 2.90 | 3.13 | 3.35 | 3.00 |

**ANOVA**

| *Source of Variation* | *SS* | *df* | *MS* | *F* | *F crit* |
|---|---|---|---|---|---|
| Variation due to causes of drought | 43.77088 | 22 | 1.989586 | 111.7798 | 1.705676 |
| Variation due to farm size | 5.097482 | 3 | 1.699161 | 95.46305 | 2.743711 |
| Error | 1.174743 | 66 | 0.017799 | | |
| Total | 50.04311 | 91 | | | |

Data presented in table 1 indicate the farm wise respondents' rating on indicators of drought. It could be noted that out of the 23 indicators of drought, the respondents rate the reduction in rainfall as the first level indicator of drought and it is evident from their secured mean score of 4.12 on a 5 point rating scale. Occurrence of dust storms is rated at second level indicator of drought and it is estimated from the respondents' secured mean score of 4.05 on a 5 point rating scale. The respondents rate the third level indicator of drought consequent upon the El Nino phenomenon. It is evident from their secured mean score of 3.97 on a 5 point rating scale. The respondents' report the fourth level indicator of drought by citing the event of lack of rainfall and it is observed from the respondents' secured mean score of 3.89 on a 5 point rating scale. Failure to store surplus rainwater during rainy season is rated at fifth level indicator of drought and it could be known from the respondents' secured mean score of 3.78 on a 5 point rating scale.

The respondents rate the soil erosion as the sixth level indicator of drought and it is revealed from their secured mean score of 3.63 on a 5 point rating scale. Diminishing crop growth is rated at seventh level indicator of drought and it observed from the respondents' secured mean score of 3.50 on a 5 point rating scale. The respondents refer the eighth level indicator of drought by citing the event of deforestation. It is evident from their secured mean score of 3.39 on a 5 point rating scale. The respondents report the ninth level indicator of drought by citing the event of late monsoon and below average rainfall as per their secured mean score of 3.28 on a 5 point rating scale. Over grazing is rated at tenth level indicator of drought and it is evident from the respondents' secured mean score of 3.15 on a 5 point rating scale.

The respondents rate the high level plant transpiration as their eleventh level observed indicator of drought and it could be known from their secured mean score of 3.07 on a 5 point rating scale. Famine is rated at twelfth level indicator of drought and it is reflected from the respondents' secured mean score of 3.00 on a 5 point rating scale. The respondents report the thirteenth level indicator of drought by citing the event of period of excessive heat. It is evident from their secured mean score of 2.89 on a 5 point rating scale. The respondents realize the fourteenth level indicator of drought by citing the event of monsoon failure and it is clear from their secured mean score of 2.74 on a 5 point rating scale. Global warming is rated at fifteenth level observed indicator of drought as per the respondents' secured mean score of 2.68 on a 5 point rating scale.

The respondents rate the low level precipitation as their sixteenth level observed indicator of drought and it could be known from their secured mean score of 2.51 on a 5 point rating scale. Climate change is rated at seventeenth level indicator of drought and it is reflected from the respondents' secured mean score of 2.46 on a 5 point rating scale. The respondents perceive the eighteenth level indicator of drought by citing the event of late onset or early withdrawal of monsoon. It is evident from their secured mean score of 2.32 on a 5 point rating scale. The respondents opine the nineteenth level indicator of drought by citing the occurrence of low moisture content and it is clear from their secured mean score of 2.24 on a 5 point rating scale. Geographical location is rated at twentieth level observed indicator of drought as per the respondents' secured mean score of 2.19 on a 5 point rating scale.

The respondents refer the twenty first level indicator of drought by citing the situation of lack of vegetative cover. It is evident from their secured mean score of 2.12 on a 5 point rating scale. The respondents rate the twenty second level indicator of drought by citing the event of occurrence of storm and it is clear from their secured mean score of 2.02 on a 5 point rating scale. Prolonged breaks in monsoon is rated at twenty third level observed indicator of drought as per the respondents' secured mean score of 1.95 on a 5 point rating scale.

The large farm household respondents' rank the first position in their overall rated drought condition in Ramnad district and it is reflected from their secured

mean score of 3.35 on a 5 point rating scale. The medium farm household respondents' record the second position in their overall observed drought condition and it is learnt from their secured mean score of 3.13 on a 5 point rating scale. The small farm households register the third position in their overall witnessed drought scenario it is revealed from their secured mean score of 2.90 on a 5 point rating scale. The marginal farm households come down to the last position in their overall observed drought condition as per their secured mean score of 2.64 on a 5 point rating scale.

The anova two ways model is applied for further discussion. The computed anova value 111.77 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the indicators drought condition is statistically identified as significant. In another point, the computed anova value 95.46 is greater than its tabulated value at 5 percent level significance. Hence variation among the farm size groups is statistically identified as significant as per the respondents rating on indicators of drought.

## Impact of Drought on Farm Households:-

This section deals with respondents' rating on impact of drought on farm households'. It can be assessed with the help of 27 factors on a 5 point rating scale. These include reduction in household income, food insecurity malnutrition, inadequate food intake, low purchasing power, limited food preferences, reduction in spending on festivals, unemployment of the households, low health status, household migration, farmers suicide, forest degradation, decline in ground water level, water quality deterioration, increase in average temperature, migration for employment, sell some livestock,
seek alternative sources of income, selecting less water consuming crop, loss of livestock, loss of poultry birds, selling lands, selling jewels and ornaments, unable to educate the children, scarcity of drinking water, long distance of fetching drinking water, and environmental warming sensation

**Table 2 Farm Wise Respondents' rating on Impact of Drought on Farm Households**

| Variables | Marginal | Small | Medium | Large | Mean |
|---|---|---|---|---|---|
| Reduction in household income | 2.03 | 2.80 | 2.22 | 2.28 | 2.16 |
| Food in security | 2.66 | 3.10 | 2.97 | 3.12 | 2.89 |
| Malnutrition | 2.92 | 2.04 | 3.26 | 3.48 | 3.19 |
| Inadequate food intake | 2.02 | 3.38 | 2.11 | 2.22 | 2.10 |
| Low purchasing power | 3.21 | 2.45 | 3.55 | 3.77 | 3.48 |
| Long distance of fetching drinking water | 2.31 | 3.30 | 2.58 | 2.72 | 2.52 |
| Reduction in spending on festivals | 3.13 | 3.72 | 3.47 | 3.69 | 3.40 |
| Unemployment of the households | 3.55 | 3.81 | 3.87 | 4.11 | 3.82 |
| Low health status | 3.64 | 3.03 | 4.03 | 4.16 | 3.91 |
| Household migration | 2.84 | 2.72 | 3.20 | 3.40 | 3.12 |
| Farmers suicide | 2.58 | 2.15 | 2.89 | 3.04 | 2.81 |
| Forest degradation | 2.07 | 2.87 | 2.27 | 2.38 | 2.22 |
| Decline in ground water level | 2.68 | 3.47 | 3.04 | 3.24 | 2.96 |
| Water quality deterioration | 3.30 | 2.54 | 3.64 | 3.86 | 3.57 |
| Increase in average temperature | 2.40 | 3.15 | 2.67 | 2.81 | 2.61 |
| Migration for employment | 2.97 | 2.23 | 3.31 | 3.53 | 3.24 |
| Sell some livestock | 2.13 | 3.99 | 2.34 | 2.48 | 2.30 |
| Seek alternative sources of income | 3.69 | 3.56 | 4.07 | 4.17 | 3.98 |
| Selecting less water consuming crop | 3.39 | 3.21 | 3.73 | 3.95 | 3.66 |
| Loss of livestock | 3.04 | 4.10 | 3.38 | 3.60 | 3.31 |
| Loss of poultry birds | 4.01 | 2.93 | 4.17 | 4.19 | 4.12 |
| Selling lands | 2.74 | 2.30 | 3.10 | 3.30 | 3.02 |
| Selling jewels and ornaments | 2.16 | 3.64 | 2.45 | 2.55 | 2.37 |
| Unable to educate the children | 3.47 | 2.37 | 3.81 | 4.03 | 3.74 |
| Scarcity of drinking water | 2.23 | 4.06 | 2.50 | 2.64 | 2.44 |
| Limited food preferences | 3.88 | 2.64 | 4.14 | 4.18 | 4.07 |
| Environmental warming sensation | 2.50 | 2.64 | 2.81 | 2.96 | 2.73 |
| Average | 2.87 | 3.02 | 3.17 | 3.33 | 3.10 |

**ANOVA**

| *Source of Variation* | *SS* | *df* | *MS* | *F* | *F crit* |
|---|---|---|---|---|---|
| Variation due to impact of drought | 41.31562 | 26 | 1.589062 | 523.8216 | 1.638019 |
| Variation due to farm size | 2.485055 | 3 | 0.828352 | 273.0594 | 2.721783 |
| Error | 0.23662 | 78 | 0.003034 | | |
| Total | 44.03729 | 107 | | | |

Data presented in table 2 indicate the farm wise respondents' rating on impact of drought on farm households. It could be noted that out of the 27 impacts of drought on farm households, the respondents rate the loss of poultry birds as the first level impact of drought on farm households and it is evident from their secured mean score of 4.12 on a 5 point rating scale. Limited food preferences is rated at second level impact of drought on farm households and it is estimated from the respondents' secured mean score of 4.07 on a 5 point rating scale. The respondents report the impact of drought on farm households by the way of seeking alternative sources of income as their third level coping mechanism. It is evident from their secured mean score of 3.98 on a 5 point rating scale. The respondents rate the fourth level impact of drought on farm households by citing the event of low health status and it is observed from the respondents' secured mean score of 3.91 on a 5 point rating scale. Unemployment of the households is rated at fifth level impact of drought on farm households and it could be known from the respondents' secured mean score of 3.82 on a 5 point rating scale.

The respondents rate the unable to educate the children as the sixth level impact of drought on farm households and it is revealed from their secured mean score of 3.74 on a 5 point rating scale. Selecting less water consuming crop is rated at seventh level impact of drought on farm households and it observed from the respondents' secured mean score of 3.66 on a 5 point rating scale. The respondents report the eighth level impact of drought on farm households by stating the situation of water quality deterioration. It is evident from their secured mean score of 3.57 on a 5 point rating scale. The respondents report the ninth level impact of drought on farm households by citing the event of low purchasing power as per their secured mean score of 3.48 on a 5 point rating scale. Reduction in spending on festivals is rated at tenth level impact of drought on farm households and it is evident from the respondents' secured mean score of 3.40 on a 5 point rating scale.

The respondents rate the loss of livestock as the eleventh level impact of drought on farm households and it could be known from their secured mean score of 3.31 on a 5 point rating scale. Migration for employment is rated at twelfth level impact of drought on farm households and it is reflected from the respondents' secured mean score of 3.24 on a 5 point rating scale. The respondents report the thirteenth level impact of drought on farm households by citing the event of malnutrition. It is evident from their secured mean score of 3.19 on a 5 point rating scale. The respondents rate the fourteenth level impact of drought on farm households by citing the event of household migration and it is clear from their secured mean score of 3.12 on a 5 point rating scale. Selling lands is rated at fifteenth level observed impact of drought on farm households as per the respondents' secured mean score of 3.02 on a 5 point rating scale.

The respondents rate the decline in ground water level as the sixteenth level impact of drought on farm households and it could be known from their secured mean score of 2.96 on a 5 point rating scale. Food insecurity is rated at seventieth level impact of drought on farm households and it is reflected from the respondents' secured mean score of 2.89 on a 5 point rating scale. The respondents rate the eightienth level impact of drought on farm households by citing the event of farmers' suicide. It is evident from their secured mean score of 2.81 on a 5 point rating scale. The respondents report the nineteenth level impact of drought on farm households by citing the scenario of environmental warming sensation and it is clear from their secured mean score of 2.73 on a 5 point rating scale. Increase in average temperature is rated at twentieth level observed impact of drought on farm households as per the respondents' secured mean score of 2.61 on a 5 point rating scale.

The respondents rate the long distance of fetching drinking water as their twenty first level impact of drought on farm households and it is revealed from their secured mean score of 2.52 on a 5 point rating scale. Scarcity of drinking water is rated at twenty second level impact of drought on farm households and it observed from the respondents' secured mean score of 2.44 on a 5 point rating scale. The respondents rate the twenty third level impact of drought on farm households by the way of selling jewels and ornaments and it is evident from their secured mean score of 2.37 on a 5 point rating scale. The

respondents report the twenty fourth level impact of drought on farm households by citing the event of selling some livestock as per their secured mean score of 2.30 on a 5 point rating scale. Forest degradation is rated at twenty fifth level impact of drought on farm households and it is evident from the respondents' secured mean score of 2.22 on a 5 point rating scale.

The respondents rate the reduction in household income as their twenty sixth level impact of drought on farm households and it could be known from their secured mean score of 2.16 on a 5 point rating scale. Inadequate food intake is rated at twenty seventh level impact of drought on farm households and it is reflected from the respondents' secured mean score of 2.10 on a 5 point rating scale.

The large farm household respondents' rank the first position in reporting the overall rated impact of drought on farm households and it is reflected from their secured mean score of 3.33 on a 5 point rating scale. The medium farm household respondents' record the second position in rating the overall observed impact of drought on farm households and it is learnt from their secured mean score of 3.17 on a 5 point rating scale. The small farm household respondents rank the third position in reporting the overall observed impact of drought on farm households it is revealed from their secured mean score of 3.04 on a 5 point rating scale. The marginal farm household respondents come down to the last position in rating overall reported impact of drought on farm households as per their secured mean score of 2.87 on a 5 point rating scale.

The anova two ways model is applied for further discussion. The computed anova value 523.82 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the overall impact of drought on farm households is statistically identified as significant. In another point, the computed anova value 273.05 is greater than its tabulated value at 5 percent level significance. Hence the variation among the farm size is statistically identified as significant as per the respondents rated impact of drought on farm households.

## Drought Mitigation:-

This section deals with respondents' rating on drought mitigation. It can be assessed with the help of 19 factors on a 5 point rating scale. These include suitable crop planning, information flow for drought early warning, soil moisture conservation techniques, rehabilitation to rebuild livelihood sources, weed management, work towards effective involvement of local people, planning sustainable recovery process, rainwater harvesting, improving rain water productivity, develop mechanism for loss and damage compensation, reconstruction of dynamic and infrastructural facilities, monitoring of regional drought season, early warming about the occurrence of drought, information flow for drought preparedness and response, prevention of monsoon rain water runoff, water erosion control, stock emergency food, feed and fodder and agricultural implements, promoting conservation agricultural practices and Water conservation.

**Table 3 Farm Wise Respondents' Rating on Drought Mitigation**

| Variables | Marginal | Small | Medium | Large | Mean |
|---|---|---|---|---|---|
| Water conservation | 2.00 | 2.05 | 2.13 | 2.24 | 2.11 |
| Rainwater harvesting | 2.91 | 3.19 | 3.48 | 3.77 | 3.35 |
| Suitable crop planning | 3.98 | 3.99 | 4.11 | 4.13 | 4.05 |
| Weed management | 3.11 | 3.51 | 3.90 | 4.12 | 3.67 |
| Early warming about the occurrence of drought | 2.35 | 2.53 | 2.84 | 3.03 | 2.69 |
| Water erosion control | 2.14 | 2.32 | 2.43 | 2.62 | 2.38 |
| Improving rain water productivity | 2.72 | 3.00 | 3.29 | 3.58 | 3.16 |
| Soil moisture conservation techniques | 3.44 | 3.86 | 4.04 | 4.11 | 3.86 |
| Prevention of monsoon rain water runoff | 2.13 | 2.41 | 2.62 | 2.71 | 2.47 |
| Rehabilitation to rebuild livelihood sources | 3.30 | 3.56 | 3.92 | 4.10 | 3.72 |
| Reconstruction of dynamic and infrastructural facilities | 2.48 | 2.76 | 3.07 | 3.36 | 2.92 |
| Planning sustainable recovery process | 2.91 | 3.30 | 3.59 | 3.99 | 3.46 |
| Promoting conservation agricultural practices | 2.01 | 2.12 | 2.23 | 2.35 | 2.18 |
| Information flow for drought early warning | 3.60 | 3.96 | 4.07 | 4.10 | 3.93 |
| Information flow for drought preparedness and response | 2.21 | 2.39 | 2.70 | 2.89 | 2.55 |
| Monitoring of regional drought season | 2.35 | 2.63 | 2.94 | 3.23 | 2.79 |
| Develop mechanism for loss and damage compensation | 2.64 | 2.92 | 3.23 | 3.52 | 3.08 |
| Stock emergency food, feed and fodder and agricultural implements | 2.12 | 2.23 | 2.34 | 2.46 | 2.29 |
| Work towards effective involvement of local people | 3.03 | 3.42 | 3.71 | 4.11 | 3.58 |
| Average | 2.71 | 2.96 | 3.19 | 3.39 | 3.07 |

**ANOVA**

| *Source of Variation* | *SS* | *df* | *MS* | *F* | *F crit* |
|---|---|---|---|---|---|
| Variation due to drought mitigation | 29.11602 | 18 | 1.617556 | 100.8853 | 1.798236 |
| Variation due to farm size | 4.002284 | 3 | 1.334095 | 83.20605 | 2.775762 |
| Error | 0.865816 | 54 | 0.016034 | | |
| Total | 33.98412 | 75 | | | |

Data presented in table 3 indicate the farm wise respondents' rating on drought. It could be noted that out of the 19 drought mitigation measures, the respondents rate the suitable crop planning is the first level drought mitigation measure and it is evident from their secured mean score of 4.05 on a 5 point rating scale. Information flow for drought early warning is rated at second level of drought mitigation measure and it is estimated from the respondents' secured mean score of 3.93 on a 5 point rating scale. The respondents recommend the soil moisture conservation techniques as their third level drought mitigation measure. It is evident from their secured mean score of 3.86 on a 5 point rating scale. The respondents suggest the fourth level drought mitigation measure by citing the need for rehabilitation to rebuild livelihood sources and it is observed from the respondents' secured mean score of 3.72 on a 5 point rating scale. Weed management is rated at fifth level drought mitigation mechanism and it could be known from the respondents' secured mean score of 3.67 on a 5 point rating scale.

The respondents rate the work towards effective involvement of local people is the sixth level drought mitigation measure and it is revealed from their secured mean score of 3.58 on a 5 point rating scale. Planning sustainable recovery process is rated at seventh level action of drought mitigation and it observed from the respondents' secured mean score of 3.46 on a 5 point rating scale. The respondents recommend the drought mitigation measure by the way of rainwater harvesting as their eighth level rating. It is evident from their secured mean score of 3.35 on a 5 point rating scale. The respondents report the ninth level drought mitigation

measure by citing the event of improving rain water productivity as per their secured mean score of 3.16 on a 5 point rating scale. Develop mechanism for loss and damage compensation is rated at tenth level drought mitigation mechanism and it is evident from the respondents' secured mean score of 3.08 on a 5 point rating scale.

The respondents rate the reconstruction of dynamic and infrastructural facilities is the eleventh level drought mitigation measure and it could be known from their secured mean score of 2.92 on a 5 point rating scale. Monitoring of regional drought season is rated at twelfth level drought mitigation mechanism and it is reflected from the respondents' secured mean score of 2.79 on a 5 point rating scale. The respondents report the thirteenth level drought mitigation measure by citing the event of early warming about the occurrence of drought. It is evident from their secured mean score of 2.69 on a 5 point rating scale. The respondents suggest the fourteenth level drought mitigation measure by citing the event of allowing information flow for drought preparedness and response and it is clear from their secured mean score of 2.55 on a 5 point rating scale. Prevention of monsoon rain water runoff is rated at fifteenth level observed drought mitigation measure as per the respondents' secured mean score of 2.47 on a 5 point rating scale.

The respondents rate the water erosion control is the sixteenth level drought mitigation measure and it could be known from their secured mean score of 2.38 on a 5 point rating scale. Stocking emergency food, feed and fodder and agricultural implements is rated at seventeenth level drought mitigation mechnism and it is reflected from the respondents' secured mean score of 2.29 on a 5 point rating scale. The respondents rate the eighteenth level drought mitigation measure by citing the need for promoting conservation agricultural practices. It is evident from their secured mean score of 2.18 on a 5 point rating scale. Water conservation is rated at nineteenth level drought mitigation measure and it is reflected from the respondents' secured mean score of 2.11 on a 5 point rating scale.

The large farm household respondents' rank the first position in their overall rated drought mitigation measures and it is reflected from their secured mean score of 3.39 on a 5 point rating scale. The medium farm household respondents' record the second position in their overall rated drought mitigation measures and it is learnt from their secured mean score of 3.19 on a 5 point rating scale. The small farm household respondents' register the third position in their overall suggested drought mitigation measures and it is revealed from their secured mean score of 2.96 on a 5 point rating scale. The marginal farm households come down to the last position in their overall recommended drought mitigation measures as per their secured mean score of 2.71 on a 5 point rating scale.

The anova two ways model is applied for further discussion. The computed anova value 100.88 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the drought mitigation measures is statistically identified as significant. In another point, the computed anova value 83.20 is greater than its tabulated value at 5 percent level significance. Hence the variation among the farm groups is statistically identified as significant as per the respondents rating on drought mitigation measures.

## Drought Coping Mechanism:-

This section deals with respondents' rating on drought coping mechanism. It can be assessed with the help of 15 factors on a 5 point rating scale. These include supplement diet, household migration, selling goats, selling cows and buffalos, selling plough, crop diversification, cultivation of drought resistant crops, recycle water use, carefully planned crop rotation, creation of drought refuge centers, using stored food during drought, public borrowings, consumption decline, pledge assets and occupational shift.

**Table 4 Farm Wise Respondents' Adopted Drought Coping Mechanism**

| Variables | Marginal | Small | Medium | Large | Mean |
|---|---|---|---|---|---|
| Supplement diet | 2.24 | 2.44 | 2.56 | 2.72 | 2.49 |
| Household migration | 2.64 | 2.84 | 2.96 | 3.13 | 2.89 |
| Selling goats | 3.01 | 3.18 | 3.35 | 3.67 | 3.30 |
| Selling cows and buffalos | 3.48 | 3.63 | 3.86 | 4.07 | 3.76 |
| Selling plough | 3.90 | 4.00 | 4.08 | 4.13 | 4.03 |
| Crop diversification | 3.13 | 3.30 | 3.47 | 3.79 | 3.42 |
| Cultivation of drought resistant crops | 1.98 | 2.02 | 2.13 | 2.35 | 2.12 |
| Recycle water use | 2.53 | 2.73 | 2.85 | 3.02 | 2.78 |
| Carefully planned crop rotation | 3.80 | 3.95 | 4.08 | 4.10 | 3.98 |
| Creation of drought refuge centres | 2.74 | 2.90 | 3.09 | 3.41 | 3.04 |
| Using stored food during drought | 1.92 | 1.98 | 2.08 | 2.23 | 2.05 |
| Public borrowings | 2.39 | 2.59 | 2.71 | 2.87 | 2.64 |
| Consumption decline | 3.41 | 3.57 | 3.79 | 4.00 | 3.69 |
| Pledge assets | 2.01 | 2.21 | 2.33 | 2.49 | 2.26 |
| Occupational shift | 2.84 | 3.00 | 3.19 | 3.51 | 3.14 |
| Average | 2.80 | 2.96 | 3.10 | 3.30 | 3.04 |

**ANOVA**

| *Source of Variation* | *SS* | *df* | *MS* | *F* | *F crit* |
|---|---|---|---|---|---|
| Variation due to drought coping mechanism | 24.04959 | 14 | 1.717828 | 367.9683 | 1.935009 |
| Variation due to farm size | 2.026727 | 3 | 0.675576 | 144.712 | 2.827049 |
| Error | 0.196073 | 42 | 0.004668 | | |
| Total | 26.27239 | 59 | | | |

Data presented in table 4 indicate the farm wise respondents' adopted on drought coping mechanism. It could be noted that out of the 15 drought coping mechanism, the respondents rate the selling plough as their first level drought coping mechanism and it is evident from their secured mean score of 4.03 on a 5 point rating scale. Carefully planned crop rotation is rated at second level drought coping mechanism and it is estimated from the respondents' secured mean score of 3.98 on a 5 point rating scale. The respondents report the third level drought coping mechanism by the way of selling cows and buffalos. It is evident from their secured mean score of 3.76 on a 5 point rating scale. The respondents adopt the fourth level drought coping mechanism by citing the event of consumption decline and it is observed from the respondents' secured mean score of 3.69 on a 5 point rating scale. Crop diversification is rated at fifth level drought coping mechanism and it could be known from the respondents' secured mean score of 3.42 on a 5 point rating scale.

The respondents rate the selling goats as their sixth level drought coping mechanism and it is revealed from their secured mean score of 3.30 on a 5 point rating scale. Occupational shift is rated at seventh level drought coping mechanism and it observed from the respondents' secured mean score of 3.14 on a 5 point rating scale. Therespondents report eighth level drought coping mechanism by the way of creation of drought refuge centres. It is evident from their secured mean score of 3.04 on a 5 point rating scale. The respondents report the ninth level drought coping mechanism by citing the event of household migration as per their secured mean score of 2.89 on a 5 point rating scale. Recycle water use is rated at tenth level drought coping mechanism and it is evident from the respondents' secured mean score of 2.78 on a 5 point rating scale.

The respondents rate the public borrowings as their eleventh level drought coping mechanism and it could be known from their secured mean score of 2.64 on a 5 point rating scale. Supplement diet is rated at twelfth level drought coping mechanism and it is reflected from the respondents' secured mean score of 2.49 on a 5 point rating scale. The respondents follow the thirteenth level drought coping mechanism by citing the event of pledge assets. It is evident from their secured mean score of 2.26 on a 5 point rating scale. The respondents practice the fourteenth level drought coping mechanism by citing the event of cultivation of drought resistant crops and it is clear from their secured mean score of 2.12 on a 5 point rating scale. Using stored food during drought is rated at fifteenth level observed drought coping mechanism as per the respondents' secured mean score of 2.05 on a 5 point rating scale.

The large farm household respondents' rank the first position in their overall rated drought coping mechanism and it is reflected from their secured mean score of 3.30 on a 5 point rating scale. The medium farm household respondents' register the second position in their overall adopted drought coping mechanism and it is learnt from their secured mean score of 3.10 on a 5 point rating scale. The small farm household respondents record the third position in their overall adopted drought coping mechanism it is revealed from their secured mean score of 2.96 on a 5 point rating scale. The marginal farm households come down to the last position in their overall adopted drought coping mechanism as per their secured mean score of 2.80 on a 5 point rating scale.

The anova two ways model is applied for further discussion. The computed anova value 367.96 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the overall drought coping mechanism is statistically identified as significant. In another point, the computed anova value 144.71 is greater than its tabulated value at 5 percent level significance. Hence the variation among the farm size is statistically identified as significant as per the respondents adopted drought coping mechanism.

## CONCLUSION

The findings of respondents' rating on indicators of drought reveal the following facts. The respondents' rate the high level observed indicators of drought by citing the events of reduction in rainfall occurrence of dust storms, El Nino phenomenon, lack of rainfall, failure to store surplus rainwater during rainy season, soil erosion and diminishing crop growth as per their secured mean score above 3.50 on a 5 point rating scale. The respondents' rate the moderate level observed indicators of drought by stating the scenarios of deforestation, late monsoon and below average rainfall, over grazing, high level plant transpiration, famine, period of excessive heat, monsoon failure, global warming and low level precipitation as per their secured mean score in the range of 2.50 to 3.50 on a 5 point rating scale. The respondents' rate the low level indicators of drought condition by indicating the events of climate change, late onset or early withdrawal of monsoon, low moisture content, geographical location, lack of vegetative cover, storm and prolonged breaks in monsoon as per their secured mean score below 2.50 on a 5 point rating scale.

The findings of respondents rating on impact of drought on their livelihood reveal the following facts. The respondents' have high level impact of drought on farm households by citing the indicators of loss of poultry birds, limited food preferences, seeking alternative sources of income, low health status, unemployment of the households, unable to educate the children, selecting less water consuming crop and water quality deterioration as per their secured mean score above 3.50 on a 5 point rating scale. The respondents' have moderate level impact of drought on farm households by stating the indicators of low purchasing power, reduction in spending on festivals, loss of livestock, migration for employment, malnutrition, household migration, selling lands, decline in ground water level, food insecurity, farmers suicide, environmental warming sensation, increase in average temperature and long distance of fetching drinking water as per their secured mean score in the range of 2.50 to 3.50 on a 5 point rating scale. The respondents' report the low level impact of drought on farm households by indicating the events of scarcity of drinking water, selling jewels and ornaments, sell some livestock, forest degradation, reduction in household income and inadequate food intake as per their secured mean score below 2.50 on a 5 point rating scale.

The respondents' rate the high level drought mitigation measures by citing the events of suitable crop planning, information flow for drought early warning, soil moisture conservation techniques, rehabilitation to rebuild livelihood sources, weed management and work towards effective involvement of local people as per their secured mean score above 3.50 on a 5 point rating scale. The respondents' rate the moderate level drought mitigation measures by stating the indicators of planning sustainable recovery process, rainwater harvesting, improving rain water productivity, developing mechanism for loss and damage compensation, reconstruction of dynamic and infrastructural facilities, monitoring of regional drought season, early warming about the occurrence of drought and information flow for drought preparedness and response as per their secured mean score in the range of 2.50 to 3.50 on a 5 point rating scale. The respondents' rate the low level drought mitigation measures by indicating the events of prevention of monsoon rain water runoff, water erosion control, stock emergency food, feed and fodder and agricultural implements, promoting conservation agricultural practices and water conservation as per their secured mean score below 2.50 on a 5 point rating scale.

The findings of respondents rating on drought coping mechanism reveal the following facts. The respondents' have high level drought coping mechanism by citing the events of selling plough, carefully planned crop rotation, selling cows and buffalos and consumption

decline as per their secured mean score above 3.50 on a 5 point rating scale. The respondents' have moderate level drought coping mechanism by stating the indicators of crop diversification, selling goats, occupational shift, creation of drought refuge centres, household migration, recycle water use and public borrowings as per their secured mean score in the range of 2.50 to 3.50 on a 5 point rating scale. The respondents' have low level drought coping mechanism by indicating the events of supplement diet, pledge assets, cultivation of drought resistant crops and using stored food during drought as per their secured mean score below 2.50 on a 5 point rating scale.

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