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Effect of Climatic and Socio-Economic Factors on Under-Utilisation of Lands in Maharashtra

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Abstract: Trends of utilization of lands across the districts of Maharashtra were analyzed over a period of 38 years (1974-75 to 2009-10). Cultivable land comprising of current fallows (CF), other fallows (OF) cultivable waste (CW) remained under-utilized in Maharashtra in spite of having scope for increasing its potentiality of use. An attempt was made to analyze the climatic and socio-economic factors responsible for the variations in under-utilization of the aforesaid three categories of lands across the districts. More than 25 per cent of cultivable land belonging to the above three categories remained under-utilized. The temporal increase in under-utilization was observed to be marginally higher in drought-prone districts than the non-drought-prone districts. The increased under-utilization of these lands in recent years may be attributed to the variation in rainfall pattern. Economic factors like irrigation played an important role in under-utilization of these lands especially in non-drought-prone districts as farmers are concentrating on more fertile land and land having irrigation facilities leaving aside the unfertile land. Rainfall and irrigation are playing the dominant role in under-utilization of cultivable land. Availability of finance for opening and deepening wells is another major factor contributing to the under-utilization of agricultural land.

Additional key words: *Cultivable wasteland, socio-economic factors, current fallow, climatic factors*

Introduction

Despite severe scarcity of land resources, about 49.33 lakh hectares of land remains unutilized in the form of cultivable waste, current and other fallows in the country. Current fallows are different than long term fallows and culturable waste both across time and space. While rainfall variation is the most dominant factor explaining the varying level of current fallows, yield levels also play an important role in respect of long term fallows and culturable waste. Though cropping pattern and cropping intensity has been a topic of interest for agricultural economists, non-cropped agricultural land (other than barren or uncultivable and forest lands) has hardly received any attention (Nadkarni and Deshpande 1979). Current fallows, other fallows, culturable waste and grazing or pasture land comes under the non-cropped agricultural land category. It is observed that there is very little scope for further utilization of grazing or pasture land (in the sense of extending cropped area and area under forest and tree crop), instead of examining it (Nadkarni and Deshpande 1979).Therefore, emphasis is laid in this paper by characterizing these three categories of land namely current fallows, other fallows, culturable waste as under-utilization of land. The whole question of under-utilization of land has hardly been explored so far despite its importance in a country with so much land hunger and poverty in rural sector (Nadkarni and Deshpande 1979). Due to the limited scope for further utilization of land for agriculture, it becomes necessary to look into the importance of under-utilized agricultural land. Besides, the level of underutilization of land reflects the allocative efficiency along with the decision making process and in turn depends on various economic, climatic and institutional factors (Reddy 1991). Climatic and institutional factors are observed to be important in determining the extent of under-utilization of land (Nadkarni and Deshpande 1979). In addition to climatic and institutional factors, economic and technological factors may also play an important role in under-utilization of land. A resource constraint also prevents farmers from cultivation in fertile lands. Technological changes in the sixties might also have brought a change in the under-utilization of land by bringing additional area under cultivation. In the initial stages, the higher return from farming due to new technology may lead to extensive cultivation and thus reduce under-utilization (Reddy 1991).

Hence there is a need to see the extent of under-utilization of land and the factor responsible for its spatial variation. The scope of this paper is limited to explaining the level of under-utilization of land (current fallow, other fallow and culturable waste) in Maharashtra. Maharashtra regularly suffers from drought. Cultivable waste, current fallow and other fallow land together constituted 8.54 per cent of geographical area of Maharashtra in 1970-1971 and subsequently increased to 11.08 percent of the geographical area of the state in 2009-2010. This indicated the increase in the quantum of under-utilization of agricultural land in the state. Therefore the present study envisages to analyse the extent of under-utilization and determinants of under-utilization.

Materials and Methods

Data on current fallows (CF), other fallows (OF) cultivable waste (CW) across the districts of Maharashtra over a period of 38 years were collected from Agricultural Statistical Information, Maharashtra state for 1974-75 to 2009-10. To study the trend in CF, OF and CW components over the period, linear growth rate for five different time periods (1974-75 to 1980-81, 1980-81 to 1989-90, 1989-90 to 1999-2000, 1999-2000 to 2009-2010 and 1974-75 2009-10) were estimated. Growth rates were estimated with respect to net sown area, current fallow, other fallow and culturalble waste land. The extent of under-utilisation of land in draught prone vis-à-vis non-drought-prone districts were estimated. Excluding Mumbai, 12 districts namely Ahmednagar, Aurangabad, Beed, Nanded, Nashik, Osmanabad, Pune, Parbhani, Hingoli, Sangli, Satara and Sholapur are declared as chronically drought prone (http://vasatwiki.icrisat.org). Accordingly, 12 of the 33 districts fall under drought prone categories and the remaining under non-drought prone category.

The preceding analysis, which is based on averages, may not hold good for all the districts. Therefore, an attempt was made to examine the factors influencing the variations in under-utilization of land across the districts with the help of multiple regression analysis. For this purpose, total fallows was culturable wastes were used as dependent variables. Analysis of current fallow is not attempted separately presuming that it is the result of immediate adjustments to severe droughts or rainfall and crop cycles (Reddy 1991). Climatic factors, represented by rainfall are the indicators for drought proneness of the district. Following the intensive cultivation hypothesis, it is expected that high rainfall and irrigated districts would have more under-utilized land (Reddy 1991). According to this hypothesis, the availability of in-situ moisture and irrigation leads to a concentration of efforts in irrigated and more fertile lands to this neglect of other less fertile lands. (Reddy 1991). Association of economic and technological factors with irrigation and rainfall contributed to the increase of under-utilized land. Reddy (1991) added some techno-economic factors to this. The factors suggested by Reddy (1991) and from other studies can be developed into a comprehensive set comprising: (i) natural endowment factors like rainfall pattern and the extent of dry land, (ii) factors representing area development pressure such as growth in urbanization, industrialization and infrastructures, (iii) factors representing sartorial development like irrigation, mechanization, commercialization and institutional development and (iv) personal factors like inability, litigation and resource base *etc*. (Pande and Tewary 1996). Following the methodology adopted by Reddy (1991), current fallows with other fallows (total fallows) were clubbed together as they were found to be highly correlated. These two dependent variables are regressed against a number of independent variables that include climatic, economic, technological and institutional factors.

Reddy (1991) in his study in Andhra Pradesh showed that under-utilization of land is influenced by climatic factors like rainfall, economic factors like irrigation, technological factors like tractorization and institutional factors like farm size, disbursement crop loan *etc*. The model is specified as follows:

TW/CW = (climatic factors) (economic factors) (technological factors) (institutional factors).

Where,

TF = Proportion of total fallow land to cultivable land.

CF = Proportion of cultivable waste to total cultivable land.

(i) Climatic factors are represented by average rainfall of the district (RF).

(ii) Economic factors include:

1) Percentage of area under net irrigation (IRR).

2) Man-Land ratio (MLR).

3) Average yield rate of cereals in kg/ha (YOC).

4) Average male wage rate (AMW).

5) Crop loan disbursed in rupees per hectare (LD).

6) Area under forest and pasture land (AFPL).

(iii) Technological factors:

1) Number of tractors per hundred hectares (TRA).

(iv) Institutional factors:

1) Farm size in hectares (FS).

Results and Discussion

Extent of under-utilization

The data for the four time points on net sown area (NSA), CF, OF, and CW are presented in Table 1 for Maharashtra along with the data of India. It could be seen from the table that more than 12 percent of the cultivable area in Maharashtra is under-utilized. The extent of under-utilization in Maharashtra is less than that of India which is around 20 per cent. Current fallow, other fallow and culturable waste constituted almost equal share in the total under-utilization (culturable land) of land of Maharashtra. Over the years, the quantum of area under current fallow area has increased by 50.47 per cent (between 1980 and 2010) in Mahashtra while during the same period current fallow area decreased by 7.82 per cent for India. Regarding other two categories, there was marginal decline during 2010. Over the period, the percent of area under-utilized in Maharashtra has recorded an increase. Contrary to this, the percentage of area under-utilized land at all India level has shown a declining trend except a marginal increase in 2000 over the nineties. The decline in the proportion of net sown area in Maharashtra is mainly due to the increase of current and other fallow to the extent of 50 and 42 per cent respectively during the period of 32 years.

Table 1. Extent of under-utilisation of land in Maharastra and India (lakh ha)

State	Year (Quinquennium ending)	Net sown area (NSA)	Current fallow (CF)	Other fallow (OF)	Culturable wastes (CW)	Total culturable land* (3+4+5+6)	Percent of area under-utilized
Maharashtra	1980	182.20 (87.11)	8.50 (4.06)	8.44 (4.04)	10.01 (4.79)	209.15 (100.00)	12.89
	1990	182.00 (86.19)	8.89 (4.21)	10.18 (4.82)	10.09 (4.78)	211.16 (100.00)	13.81
	2000	179.00 (84.70)	10.91 (5.16)	12.23 (5.79)	9.19 (4.35)	211.33 (100.00)	15.30
	2010	175.38 (83.80)	12.79 (6.11)	11.98 (5.72)	9.14 (4.37)	209.29 (100.00)	16.20
India	1980	1400.00 (77.14)	148.30 (8.17)	99.20 (5.47)	167.40 (9.22)	1814.90 (100.00)	22.86
	1990	1430.00 (78.85)	137.00 (7.55)	96.60 (5.33)	150.00 (8.27)	1813.60 (100.00)	21.15
	2000	1410.80 (78.50)	149.00 (8.29)	101.10 (5.63)	136.40 (7.59)	1797.30 (100.00)	21.51
	2010	1418.90 (79.19)	136.70 (7.63)	105.00 (5.86)	131.20 (7.32)	1791.80 (100.00)	20.81

Source: Agricultural statistical Information, Maharashtra State, (Various issues), Commissioner ate of Agriculture, Maharashtra State, Pune. * Excluding land under miscellaneous tree crops and forests.
(Figures in parentheses indicate percentage to total culturable land)

It is interesting to note that the increase of current fallow is much higher during post nineties as compared to the eighties. Against this, area under other fallow showed a decline to the extent of 2 per cent during the period 2000 to 2010, while the culturable waste land declined to the extent of 9 per cent during the study period of 32 years. Population pressure and other associated factors like technology development and numerous government programmes have led to a reduction of cultivable waste and other fallow (Chadha *et al.* 2004). Of these three categories, current fallow reflects the high inverse relationship with year to year rainfall variations (Reddy 1991; Chadha *et al.* 2004). This indicates that the rainfall plays a dominant role in determining the current fallow land.

Other fallows are the continuation of current fallow for more than one year and up to five years (Bansil 1970). The presence of other fallows may represent the soil-climatic characters, resource base, un-remunerative nature of farming and level of technology of the region (Reddy 1991). Other fallows are determined more by rural population pressure on land (Chadha *et al.* 2004). Culturable waste is the land once cultivated but not cultivated for five years in succession and is let out of cultivation mainly due to the resource constraints and economics of its cultivation (Reddy 1991). Of these three, current fallows can be left out as it depends mostly on year to year rainfall and also due to the reason that it is a part of the crop rotation system followed by the farmers (Reddy 1991). Even after taking out this component, extent of under-utilization is as high as 10 per cent which is considered very high in a highly populous, land hungry and poor country.

The estimates linear growth rates (Table 2) revealed that the net sown area declined, though not significant, over the period of 37 years. This decline is mainly during nineties after the start of the globalization process in 1991. Current fallow and other fallow have also recorded a non-significant positive growth rate over the period expect for the other fallow during the period 1999-2000 to 2005-06.Culturable waste lands have showed a non-significant decline in all the period except 1980-81 to 1989-90. The decline in culturable wastes after 1970 indicates that the resource constraints of the cultivator must have eased off consequent to the improved yields brought by technological change (Reddy 1991). Although fluctuation in current fallow is partially explained by rainfall variations, negative externality impact of technology in general, and irrigation in particular, could explain the upward trend of current fallow (Chadha *et al.* 2004). In case of other fallows, it is observed that the more productive the land, the less are the chances of leaving land fallow for a longer period of time. Yield has been a significant variable affecting long-term under-utilization of agricultural land (Chadha *et al.* 2004). Increase in variation of rainfall and yield looks to be the plausible reason for overall increase in current and other fallow lands after nineties in Maharashtra (Table 1). At this juncture, the analysis of the extent of under-utilization of land in draught prone vis-à-vis non-drought-prone districts would be revealing and interesting.

Table 2. Estimates of linear growth rates for various components of land under-utilisation in Maharashtra

Period	Net sown area	Current fallow	Other fallow	Culturable waste
1974-75 to 1980-81 N = 7	-0.005 (0.75)	0.173 (1.20)	0.161 (1.06)	-0.037 (0.87)
1980-81 to1989-90 N = 10	-0.115 (0.983)	0.099 (0.530)	0.414 (0.675)	0.028 (0.610)
1989-90 to 1999-2000 N = 10	-0.660 (5.10)	0.061 (0.08)	0.150 (0.473)	-0.082 (0.48)
1999-2000 to 2009-10 N = 11	-0.374 (0.674)	0.262 (1.63)	-0.125 (0.477)	-0.037 (0.530)
1974-75 to 2009-10 N = 38	-0.263 (2.08)	0.168 (0.679)	0.169 (0.575)	-0.038 (0.084)

Figures in parentheses indicate standard error. (-) indicate decline.

The data pertaining to the magnitude of the three categories of under-utilization are presented in Table 3 along with their growth rates for different periods. It can be observed from the table that the extent of current fallow and other fallow are higher in drought–prone districts than in the non-drought-prone districts. The magnitude of current fallow has increased over the period in both the drought and non-drought districts. The quantum of land under culturable waste is observed to be higher in non-drought-prone districts than the drought-prone districts. Overall magnitude of under utilization is recorded to be higher in drought-prone-districts than the non-drought-prone districts. Non drought prone districts have shown a marginal increase between 2000 and 2010 while the drought prone districts recorded a decline. However, it is notable that the gap between the magnitude of under-utilisation in the drought and non-drought districts has decreased between 2000 and 2010.

The growth rate also indicates significant decline in net sown area in the post ninety period in drought prone districts, while the growth rate was showing a non-significant declining trend during the periods 1981-

90 and 2001 to 2010 in non-drought-prone districts. In the case of current fallow, both the group recorded significant positive growth rate during the 38 years period. The uncertainty of onset of monsoon and the unsure moisture availability during the critical phases of crop growth often force the farmers of Vertisol region (Maharashtra) to keep their land fallow during monsoon season (Sen 2003). Other fallow recorded a significant positive growth rate in drought prone districts where as it showed non-significant positive growth rate for both the group of districts.

Table 3. Extent and trends in under utilization in drought and non-drought districts (lakh ha)

Source: Agricultural Statistical Information, Maharashtra State (for various years). @ Figures in parentheses indicate percentage to total area. # Figures in parentheses indicate standard error. *Significant at 05 per cent level. **Significant at 01 per cent level.

The extent of under-utilization is mainly because the fallow land has increased over the period. Its considerable rise over the period needs some attention. It can be observed from table 3 that total fallow land (CF + OF) have increased from 8.58 per cent in 1980 to 11.57 per cent in 1990, 12.82 per cent in 2000 and further to 13.75 per cent in 2005 in drought-prone districts, while they have increased from 7.10 per cent in 1980 to 9.85 per cent in 2010 in non-drought-prone districts. Of these two categories, the growth of other fallow land is substantially higher in the drought-prone districts when compared to the non-drought-prone districts. This indicates the continuous monsoon failure in these districts resulting in the land becoming increasingly uneconomical for cultivation over the period (Reddy 1991). The erratic and skewed distribution of rainfall during recent years as indicated by high coefficient of variation of rainfall both for drought prone (47%) and non-drought-prone (77%)

districts contributed to increase in current fallow in recent years. On the other hand, the new technology may be more effective in the high rainfall and irrigated districts where the area under other fallow has shown a marginal decline in recent period (2009-10), irrespective of low and variant rainfall. The reason for this may be that the cultivation might have become more economical in these districts after the advent of new technology when compared to drought-prone districts (Reddy 1991). Increase in clulturable waste, in recent times in both drought-prone and non-drought-prone districts, may be due to high cost involved in developing this land as it cannot be done without the direct involvement of development agencies.

Determinants of under-utilization : district-wise analysis

The analysis was carried out in 2009-10. However, in order to test the robustness of the results, the estimates were presented for earlier years of 1980 and 1990 also. The estimates of selected equations are presented in Table 4 and 6. The results are discussed separately for fallows and culturable wastes across the districts and also for drought-prone and non-drought-prone districts.

i) Factor influencing total fallows in all the districts

Three specifications (one each for 1980-81, 1990-91 and 2009-10) were considered for explaining the variation in total fallow land. The results (Table 4) indicated that four variables namely rainfall, net irrigated area (NIA), area under forest and pasture land (AFPL) and man-land ration (MLR) are significant in explaining the variation across the districts.

Rainfall showed a positive association, indicating that rainfall results in increase in total fallow land. In the rainy season, since the probability of occurrence of water logging is perceived high in Vrtisols (heavy black clay soil). Around 97 percent of total geographical area of Maharashtra is Vertisols. Vertisols are characterized by severe water logging during rainy season. Vertisol areas farmers avoid much of the water logging problem by planting late, towards the end of the rainy season. Thus risk averse farmers would tend to fallow the land (both dry and irrigable) till the end of rainy days to reduce risk (Dwivedi *et al.* 2006).

Table 4. Factor influencing total fallow lands across the districts

Variable	1980-81	1990-91	2009-10
Rainfall (RF)	0.008*** (6.452)	0.025 (11.437)	0.016*** (8.055)
Net irrigated area (NIA)	1.206*** (3.489)	0.345*** (2.876)	0.266*** (2.643)
Size of holding (FS)	2.031 (1.420)	4.182 (1.27)	3.615 (1.209)
Forest & pasture land (AFPL)	-0.472*** (-4.692)	-0.245*** (-4.382)	-0.387*** (-5.367)
Man-land ratio (MLR)	-11.823*** (-6.453)	-21.468*** (-7.038)	-31.526*** (-6.908)
Wage rate (WR)	0.543 (0.498)	0.413 (0.734)	0.115 (0.885)
Tractor (TRA)	0.997 (0.677)	-3.324 (-0.53)	-1.72 (-0.384)
Crop loan (LD)	-	0.24 (0.829)	0.001 (0.906)
Cereal yield (YOC)	0.34 (0.834)	0.023 (0.214)	-0.001 (-0.413)
R^2	0.850	0.914	0.954
F value	20.56	23.48	26.05
N	26	29	32

Figures in parentheses are‘t’ values.*, **, *** indicate level of significance at 1, 5 and 10 per cent respectively.

Note: The specifications used are, [1] $TF = a+ b_1 RF+b_2 NIA+b_3 FS+b_4 AFPL+b_5 MLR+b_6 WR+b_7 TRA+b_8 LD+b_9 YOC$ (1979-80, 1989-90, 2009-10)

Immediately after onset of monsoon, the Vertisol (major soil of Maharashtra) becomes plastic and sticky and any forms of mechanical tillage during the wet period results into severe soil compaction (Sen 2003). So, the workability of soil becomes restricted to a very limited period of optimal soil-moisture condition and it becomes difficult for the farmers to get adequate time for seed bed preparation. As a result most of the land remains fallow during monsoon period. Thus significant positive association is revealed between rainfall and total fallow land. The net irrigated area revealed a significant positive association. This may be due to the reason that in the regions with well irrigation, the availability of water is comparatively assured during the most part of the year and also due to the farmers' control over water, more concentrated efforts are put on irrigated and fertile lands by neglecting the less fertile lands (Reddy 1991).

i) Factors influencing culturable waste in all the districts

Rainfall, net irrigated area, size of holding, forest and pasture land and man-land ratio are observed to have significant effect on the culturable waste land (Table 5). Rainfall and irrigation lead to the greater concentration on fertile lands leaving aside the unfertile and waste land. Interestingly, the area under culturable waste seems to be more in areas having higher rainfalls as the development agencies are not interested to develop these lands due to the sufficiency of fertile land for cultivation. High cost of reclamation may be another reason for increase in area under culturable waste as it cannot be done without Government assistance. Under-utilization of land in terms of culturable waste is higher in areas having higher rainfall and irrigation. This is true even in case of total fallow land. Similar findings were reported by Dwivedi *et al.* (2006). Forest and pasture land has a significant negative impact on culturable waste land as encroachment on forest, pasture land (the culturable waste land) may increase due to the non-availability of alternative technologies for developing these lands for generating alternate source of employment. This is consistent with the results obtained in case of total fallow land. Man-land ratio has also shown inverse relationship with the culturable waste land as the increase of population may lead to higher demand for land converting this under-utilised culturable waste into more utilizable form. This corroborates with the results obtained in case of total fallow land.

Table 5. Factor influencing culturable waste across the districts

Variable	1980-81	1990-91	2009-10
Rainfall (RF)	0.023*** (7.380)	0.010*** (12.085)	0.007*** (8.731)
Net irrigated area (NIA)	0.745*** (4.182)	0.234*** (3.443)	0.14*** (3.182)
Size of holding (FS)	1.396** (2.044)	2.235* (1.669)	2.089* (1.594)
Forest & pasture land (AFPL)	-0.140*** (-3.470)	-0.087** (-2.307)	-0.083*** (-2.613)
Man-land ratio (MLR)	-7.823*** (-3.898)	-4.324*** (-3.006)	-5.901*** (-2.951)
Wage rate (WR)	0.143 (0.926)	0.009** (1.965)	0.112** (1.952)
Tractor (TRA)	0.145 (0.567)	-0.620 (-0.338)	-0.379 (-0.379)
Crop loan (LD)	0.008 (0.859)	0.003 (0.906)	-0.001 (-0.0451)
Cereals yield (YOC)	0.010 (0.212)	-0.003 (-0.032)	-0.001 (-0.0451)
R^2	0.820	0.873	0.902
F-value	22.08	24.37	26.21
N	26	29	32

Figures in parentheses are 't' values. *, **, *** indicate level of significance at 1, 5 and 10 per cent respectively.
Note: The specifications used are, $CW = a + b_1 RF + b_2 NIA + b_3 FS + b_4 AFPL + b_5 MLR + b_6 WR + b_7 TRA$ (1980-81, 1990-91, 2009-10)

Increase in wage rates may have a negative effect on extensive cultivation as the higher wages may prevent cultivation of culturable waste. Reddy (1991) reported similar findings in his study on Andhra Pradesh. However this may be change over time with the development of mechanization. Thus the present analysis clearly brings out that rainfall and irrigation have influence on underutilization of land in terms of fallow land and culturable wastes.

i) Factors influencing total fallow in drought-prone and non-drought prone districts

Rainfall is observed to be the significant factor influencing total fallow land in both drought-prone and non-drought prone district (Table 6). It is found to be positively significant at 1 per cent level in non-drought prone districts, while it has significant positive association at 5 per cent level in drought-prone districts. Forest and pasture land showed an inverse relationship with total fallow land as encroachment on forest and pasture land may increase while fallow lands are neglected. Forests, particularly those providing free access, village woodlots, grazing lands, tank beds and forest shores have all played an important role in supporting not only agriculture and land holding families but the landless too in meeting their basic needs of fuel and fodder (Nadkarni and Pasha 1991). Man-land ratio showed a negative relationship with total fallow land, indicating that the higher the availability of manpower, the lower will be the area under fallows. Similar findings were also reported by Reddy (1991). The results are consistent for all the sets of data of these different periods.

Table 6. Factors influencing total fallow lands in drought prone and non-drought-prone district. (2009-10)

Variable	Drought Prone	Non-Drought Prone
Rainfall (RF)	0.006**(2.309)	0.016*** (6.264)
Net irrigated area (NIA)	-0.103 (-1.223)	0.382*** (3.067)
Size of holding (FS)	1.78(0.994)	8.065* (1.503)
Forest & pasture land (AFPL)	0.069 (0.475)	-0.24** (-2.108)
Man-land ratio (MLR)	-11.968* (-1.569)	--27.883*** (-3.238)
Wage rate (WR)	-0.035 (-0.335)	0.367** (2.07)
Tractor (TRA)	4.313 (0.913)	8.713 (0.275)
Crop loan (LD)	0.001 (0.95)	-0.001 (-0.423)
Cereals yield (YOC)	-0.003 (-0.797)	0.002 (0.482)
R^2	0.833	0.973
F- value	32.93	32.35
N	14	18

Figures in parentheses are ‘t’ values.*, **, *** indicate level of significance at 1, 5 and 10 per cent respectively
Note: The specifications used are, $TF = a + b_1 RF + b_2 NIA + b_3 FS + b_4 AFPL + b_5 MLR + b_6 WR + b_7 TRA + b_8 LD + b_9 YOC$ (2005-06)

Erratic and irregular rainfall contributed to growth in total fallow land. Difference in co-efficient of variation of rainfall may affect in this change. Man land ratio shows inverse relationship with the total fallow land. This is due to the fact that higher the availability of manpower, lesser will be the area under total fallow. Net irrigated area has significant positive association at one per cent level for non-drought-prone districts indicating the most effective role in increasing the total fallow land. It may be due to the reason that the farmers from non-drought prone districts used the irrigated and fertile land more intensively due to the wells where large investments have been made leaving aside the unfertile and waste land causing growth in total fallow land. Average size of holding shows significant positive association at 10 per cent level for non-drought-prone districts. This tends to signify that the farmers in the non-drought-prone districts can afford to take the risk of keeping the land fallow in the event of uncertain rainfall, but farmers from drought prone districts may not take the risk of keeping land fellow depending on the expected rainfall. Forest and pasture land shows significant negative association with total fallow in non-drought-prone districts. This may be due to the fact that when alternative avenue for jobs, food, fuel *etc*. are not available, pressure on forest and pasture land will be more for earning livelihood. Significant positive association is observed between wage rate and total fallow in non-drought-prone districts. This may be attributed to non-availability of labour for agricultural operations.

(iv) Factors influencing culturable waste in drought prone and non-drought-prone districts

In the case of culturable waste, rainfall and man-land ratio have significant positive association for both drought-prone and non-drought-prone districts (Table 7). Erratic and irregular rainfall contributes to increase in culturable waste. Man-land ratio is having inverse relationship with the total fallow as more hands are required to bring more land under cultivation. Highly significant positive association is observed between net irrigated area (NIA) and culturabe waste in non-drought-prone districts. Significant negative association is observed for crop loan in case of non-drought prone districts. Understanding the factors behind the decision to land unused has always has been of great interest for policy makers. Higher wages are detrimental to extensive cultivation due to which there is an increase in total fallow land.

Table 7. Factors influencing culturable wasete across drought prone and non-drought-prone districts (2009-2010)

Variable	Drought Prone	Non-Drought Prone
Rainfall (RF)	0.006** (2.306)	0.009*** (7.999)
Net irrigated area (NIA)	-0.103 (-1.223)	0.196*** (3.801)
Size of holding (FS)	1.78 (0.994)	2.502 (1.222)
Forest & pasture land (AFPL)	0.069 (0.475)	-0.102** (2.159)
Man-land ratio (MLR)	-11.968* (-1.569)	-5.55* (-1.552)
Wage rate (WR)	-0.035 (-0.355)	0.176** (2.393)
Tractor (TRA)	4.313 (0.913)	2.653 (0.215)
Crop loan (LD)	0.001 (0.95)	-
Cereals yield (YOC)	-0.003 (-0.797)	-0.003* (-1.626)
R^2	0.833	0.974
F- value	2.21	32.933
N	14	18

Figures in parentheses are 't' values. *, **, *** indicate level of significance at 1, 5 and 10 per cent respectively.

Note: The specifications used are for drought prone districts-CW = a+ b_1 RF+b_2 NIA+b_3 FS+b_4 AFPL+b_5 MLR+b_6 WR+b_7 TRA +b_8 LD+b_9 YOC (2009-10). For non-drought-prone districts- CW = a+ b_1 RF+b_2 NIA+b_3 FS+b_4 AFPL+b_5 MLR+b_6 WR+b_7 LD +b_8 YOC (2009-10)

Walker and Ryan (1990) in their studies on semi-arid-tropics reported that the land owners in Vidarbha sometimes sold dry land fields and purchased land adjacent to their well. Therefore concentration is more towards irrigation and fertile land leaving aside the non-fertile and culturable waste land. This led to the increase in culturable waste land in irrigated areas. The profitability of wet land agriculture was further enhanced by public subsidies on fertilizer, diesel and electricity. Such subsidies and greater pace of technical change in irrigated agriculture certainly diminish acquisition pressure on predominantly rainfed land. Wage rate is found to have significant negative association in non-drought-prone districts. Higher wages are detrimental to extensive cultivation which may obviously be due to higher cost involved consequent to the enormous amount of labour required to bring the culturable waste under cultivation, especially in the absence of mechanization (Reddy 1991). This is because farmers preferred to take loan only for fertile land. Understanding the factors behind the decision to keep land unused has always has been of great interest for policy makers. The present analysis clearly brings out that rainfall and irrigation influences underutilization of land in terms of fallow land and culturable wastes. In addition to rainfall and irrigation, other economic factors like man-land ratio, average male wage rate, seem to play quite an important role in determining under-utilization of land. Institutional factors like farm size showed a strong positive association with culturable waste in the analysis across the districts. This signifies that big farmers tend to keep the waste land unutilized without any reclamation. High cost of reclamation may be the reason for such un-utilization of culturable waste.

Conclusion

The analysis has clearly shown that more than 25 per cent of agricultural land remains under-utilized is a matter of concern. The increase in under-utilization is observed to be marginally higher in drought-prone districts than the non-drought-prone districts. The increase in under-utilization of land in recent years may be attributed to the variation in rainfall pattern. Economic factors like irrigation played an important role in under-utilization of land especially in non-drought-prone districts as farmers are concentrating more on fertile land and land having irrigation facilities leaving aside the unfertile land.

There is, therefore need for adoption of proper soil and water conservation measures along with the development of irrigation facilities, which may bring down the level of under-utilization in Maharashtra.

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