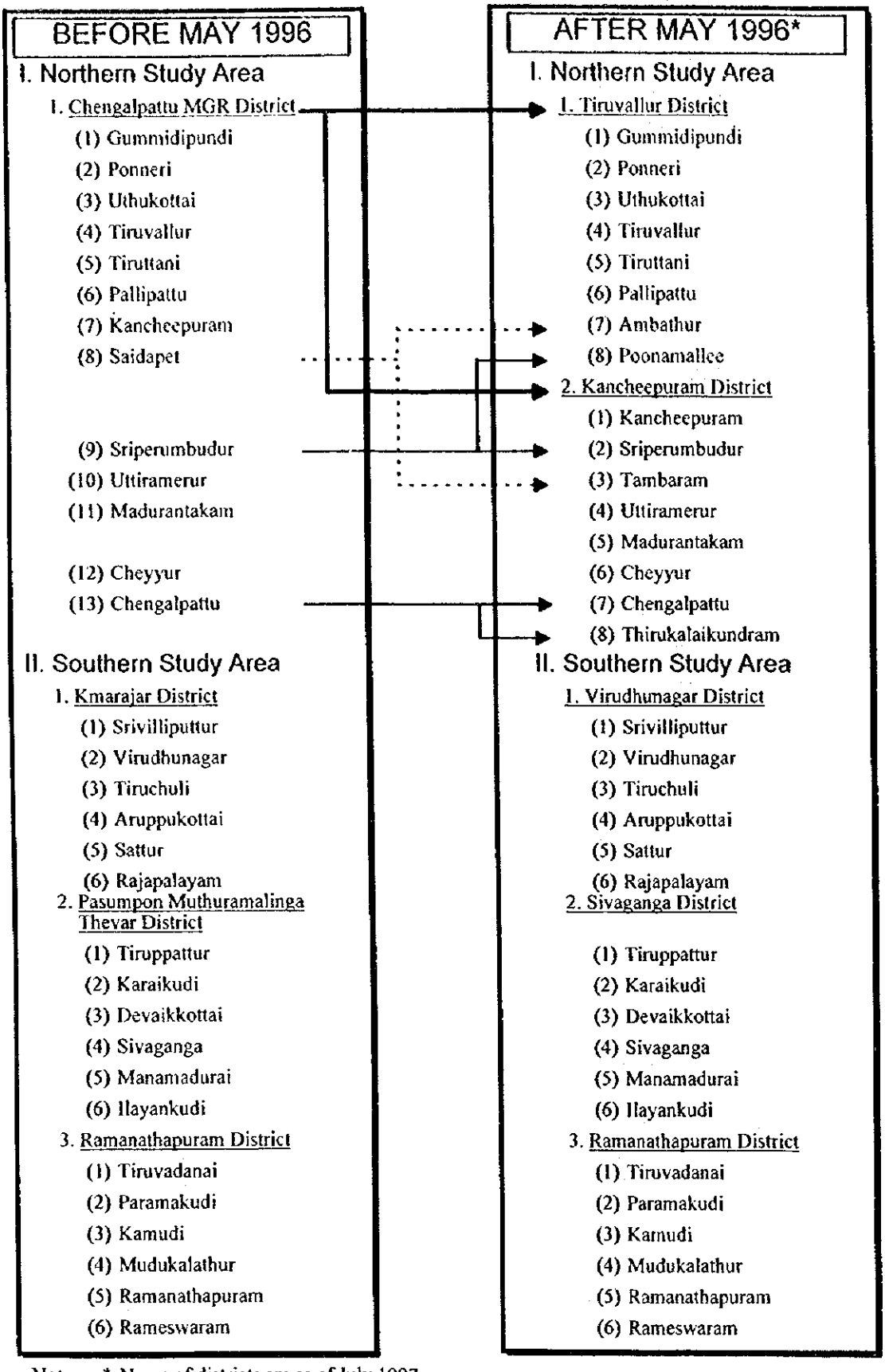
## Table 3.1.1 Districts and Taluks in the Study Area

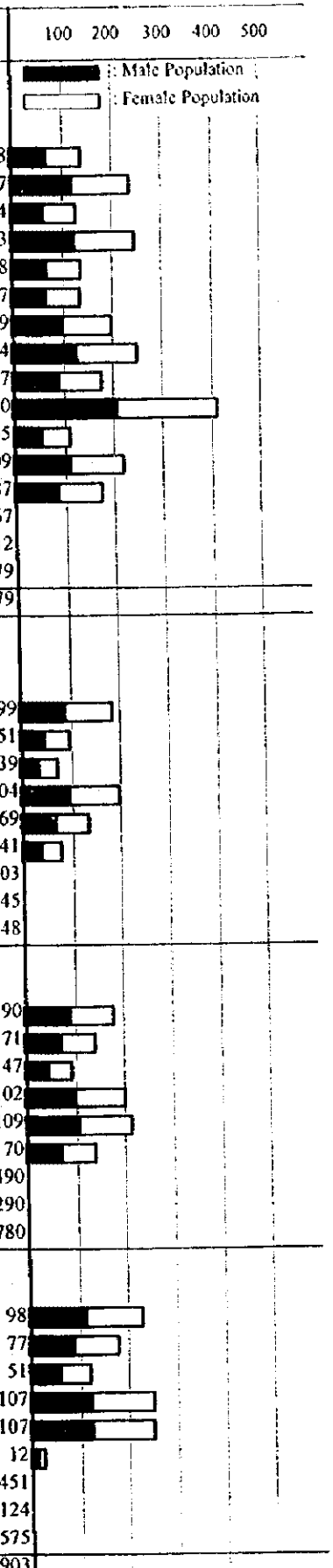



Note : * Name of districts are as of July 1997

## Table 3.1.2 Taluk-wise Population

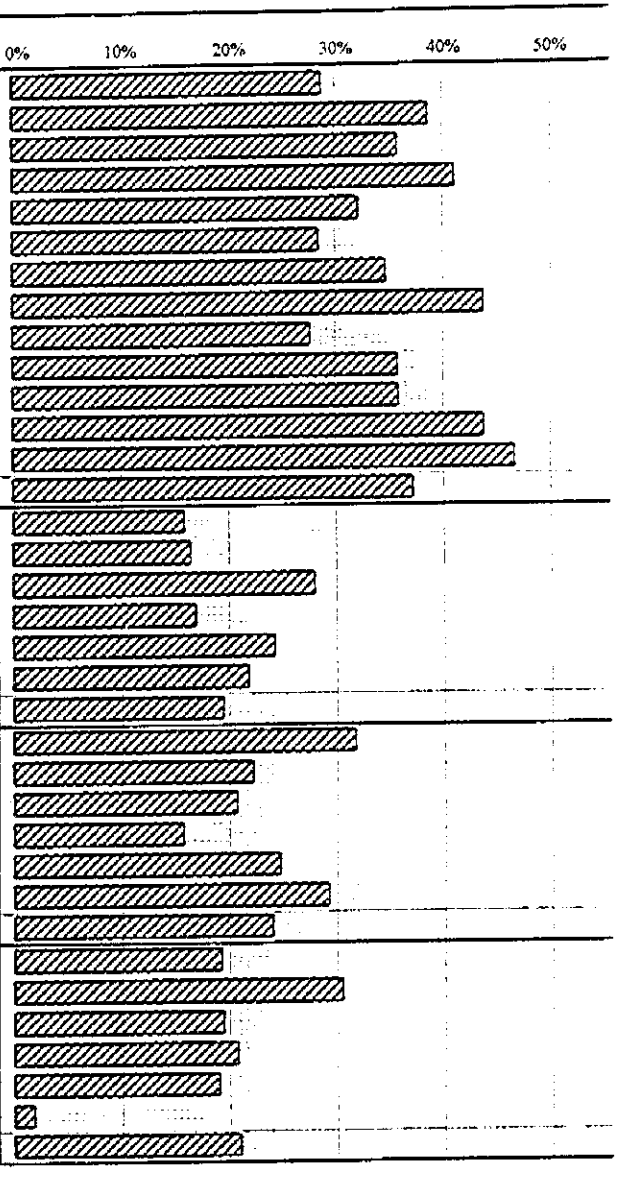
($10^3$ Persons)

| District and Talk | Household | Total Population | Male Population | Female Population |
|---|---|---|---|---|
| I. Northern Study Area | | | | |
| 1. Tiruvallur & Kanchipuram (Former Chengalpattu MGR) | | | | |
| (1) Rural Area | | | | |
| Gumnidipundi | 32 | 139 | 71 | 68 |
| Ponneri | 54 | 237 | 120 | 117 |
| Uthukottai | 30 | 128 | 64 | 64 |
| Tiruvallur | 55 | 247 | 124 | 123 |
| Tiruttani | 31 | 137 | 69 | 68 |
| Pallipattu | 29 | 135 | 68 | 67 |
| Kancheepuram | 43 | 199 | 100 | 99 |
| Sriperumbudur | 53 | 250 | 127 | 124 |
| Saidapet | 39 | 178 | 91 | 87 |
| Chengalpattu | 88 | 408 | 208 | 200 |
| Uttiramerur | 24 | 111 | 56 | 55 |
| Madurantakam | 47 | 220 | 111 | 109 |
| Cheyyur | 38 | 175 | 88 | 87 |
| Sub-total | 562 | 2,566 | 1,298 | 1,267 |
| (2) Urban Area | 447 | 2,088 | 1,076 | 1,012 |
| Total | 1,008 | 4,654 | 2,375 | 2,279 |
| Total of Northern S. A. | 1,008 | 4,654 | 2,375 | 2,279 |
| II. Southern Study Area | | | | |
| 1. Sivagangai | | | | |
| (1) Rural Area | | | | |
| Tiruppattur | 45 | 191 | 92 | 99 |
| Karaikudi | 23 | 100 | 49 | 51 |
| Devaikkottai | 17 | 75 | 36 | 39 |
| Sivaganga | 46 | 203 | 99 | 104 |
| Manamadurai | 31 | 138 | 69 | 69 |
| Ilayankudi | 18 | 81 | 40 | 41 |
| Sub-total | 180 | 788 | 385 | 403 |
| (2) Urban Area | 62 | 290 | 145 | 145 |
| Total | 242 | 1,078 | 530 | 548 |
| 2. Kvirudunagar | | | | |
| (1) Rural Area | | | | |
| Srivilliputtur | 45 | 182 | 91 | 90 |
| Virudhunagar | 33 | 142 | 71 | 71 |
| Tiruchuli | 21 | 94 | 47 | 47 |
| Aruppukottai | 49 | 204 | 101 | 102 |
| Sattur | 53 | 217 | 108 | 109 |
| Rajapalayam | 36 | 141 | 70 | 70 |
| Sub-total | 237 | 979 | 489 | 490 |
| (2) Urban Area | 138 | 586 | 296 | 290 |
| Total | 376 | 1,565 | 785 | 780 |
| 3. Ramanathapuram | | | | |
| (1) Rural Area | | | | |
| Tiruvadanai | 41 | 194 | 96 | 98 |
| Paramakudi | 34 | 151 | 75 | 77 |
| Kamudi | 23 | 102 | 51 | 51 |
| Mudukalathur | 46 | 212 | 105 | 107 |
| Ramanathapuram | 45 | 212 | 105 | 107 |
| Rameswaram | 5 | 24 | 12 | 12 |
| Sub-total | 195 | 894 | 443 | 451 |
| (2) Urban Area | 50 | 250 | 125 | 124 |
| Total | 244 | 1,144 | 569 | 575 |
| Total of Southern S. A. | 862 | 3,787 | 1,884 | 1,903 |



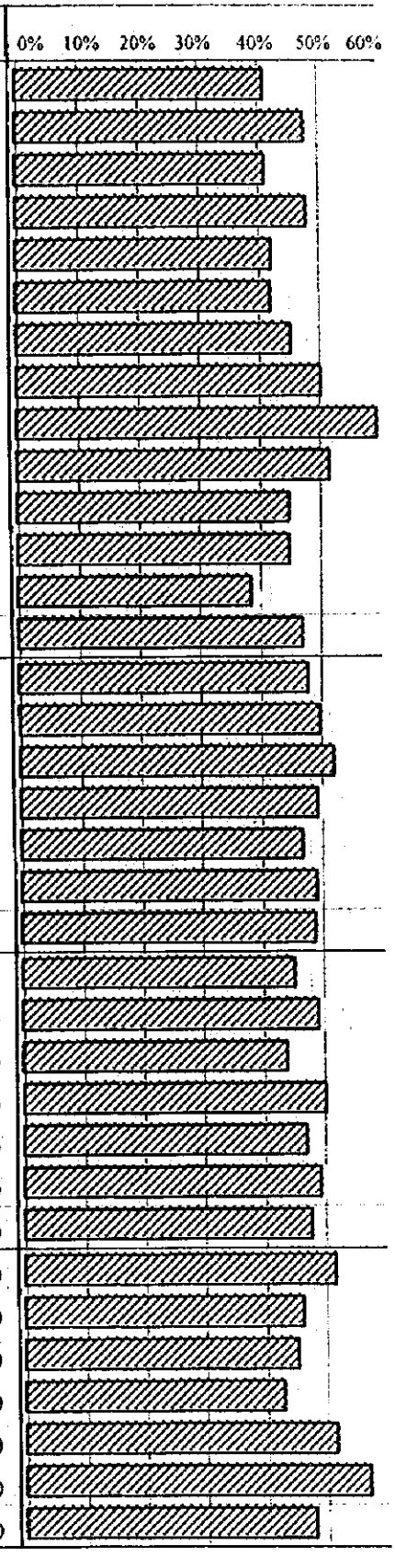
## Table 3.1.3 Population of Scheduled Caste and Tribe in the Rural Areas of Study Area

| District | Name of Taluk | Population in Rural Area | Scheduled Caste (SC) | | | Scheduled Tribe (ST) | | | Total of SC+ST (%) |
|---|---|---|---|---|---|---|---|---|---|
| | | | Male | Female | Total (%) | Male | Female | Total (%) | |
| Tiruvallur & Kanchipuram | Gummidipundi | 139,111 | 18,418 | 18,187 | 36,605 (26.3) | 1,501 | 1,408 | 2,909 (2.1) | 39,514 (28.4) |
| | Ponneri | 237,333 | 43,491 | 42,573 | 86,064 (36.3) | 2,255 | 2,254 | 4,509 (1.9) | 90,573 (38.2) |
| | Uthukottai | 128,063 | 21,001 | 20,669 | 41,670 (32.5) | 1,821 | 1,815 | 3,636 (2.8) | 45,306 (35.4) |
| | Tiruvallur | 247,188 | 47,534 | 47,134 | 94,668 (38.3) | 2,814 | 2,775 | 5,589 (2.3) | 100,257 (40.6) |
| | Tiruttani | 137,154 | 20,327 | 19,563 | 39,890 (29.1) | 1,881 | 1,817 | 3,698 (2.7) | 43,588 (31.8) |
| | Pallipattu | 135,255 | 17,418 | 16,651 | 34,069 (25.2) | 1,999 | 1,957 | 3,956 (2.9) | 38,025 (28.1) |
| | Kancheepuram | 199,076 | 33,100 | 32,688 | 65,788 (33.0) | 1,191 | 1,191 | 2,382 (1.2) | 68,170 (34.2) |
| | Sriperumbudur | 250,445 | 53,070 | 52,494 | 105,564 (42.2) | 1,321 | 1,282 | 2,603 (1.0) | 108,167 (43.2) |
| | Saidapet | 177,752 | 23,673 | 23,242 | 46,915 (26.4) | 847 | 857 | 1,704 (1.0) | 48,619 (27.4) |
| | Chengalpattu | 408,237 | 69,666 | 67,889 | 137,555 (33.7) | 3,394 | 3,283 | 6,677 (1.6) | 144,232 (35.3) |
| | Uttiramerur | 111,219 | 19,028 | 18,344 | 37,372 (33.6) | 1,019 | 986 | 2,005 (1.8) | 39,377 (35.4) |
| | Madurantakam | 220,135 | 46,532 | 44,949 | 91,481 (41.6) | 1,876 | 1,789 | 3,665 (1.7) | 95,146 (43.2) |
| | Cheyyur | 174,615 | 39,717 | 38,979 | 78,696 (45.1) | 875 | 790 | 1,665 (1.0) | 80,361 (46.0) |
| | Total or Ave. | 2,565,583 | 452,975 | 443,362 | 896,337 (34.9) | 22,794 | 22,204 | 44,998 (1.8) | 941,335 (36.7) |
| Sivagangai | Tiruppattur | 190,902 | 14,382 | 15,223 | 29,605 (15.5) | 50 | 46 | 96 (0.1) | 29,701 (15.6) |
| | Karaikudi | 99,857 | 7,581 | 8,410 | 15,991 (16.0) | 68 | 67 | 135 (0.1) | 16,126 (16.1) |
| | Devaikkottai | 75,090 | 9,892 | 10,639 | 20,531 (27.3) | 13 | 9 | 22 (0.0) | 20,553 (27.4) |
| | Sivaganga | 203,058 | 16,558 | 17,009 | 33,567 (16.5) | 36 | 52 | 88 (0.0) | 33,655 (16.6) |
| | Manamadurai | 138,391 | 16,581 | 16,275 | 32,856 (23.7) | 0 | 0 | 0 (0.0) | 32,856 (23.7) |
| | Ilayankudi | 80,701 | 8,539 | 8,687 | 17,226 (21.3) | 0 | 0 | 0 (0.0) | 17,226 (21.3) |
| | Total or Ave. | 787,999 | 73,533 | 76,243 | 149,776 (19.0) | 167 | 174 | 341 (0.0) | 150,117 (19.1) |
| Virudunagar | Srivilliputtur | 181,736 | 29,230 | 28,548 | 57,778 (31.8) | 94 | 105 | 199 (0.1) | 57,977 (31.9) |
| | Virudhunagar | 142,199 | 16,047 | 15,654 | 31,701 (22.3) | 35 | 29 | 64 (0.0) | 31,765 (22.3) |
| | Tiruchuli | 94,042 | 9,859 | 9,648 | 19,507 (20.7) | 46 | 41 | 87 (0.1) | 19,594 (20.8) |
| | Aruppukottai | 203,747 | 16,223 | 15,937 | 32,160 (15.8) | 83 | 86 | 169 (0.1) | 32,329 (15.9) |
| | Sattur | 216,818 | 27,086 | 26,658 | 53,744 (24.8) | 41 | 47 | 88 (0.0) | 53,832 (24.8) |
| | Rajapalayam | 140,791 | 20,355 | 20,607 | 40,962 (29.1) | 210 | 199 | 409 (0.3) | 41,371 (29.4) |
| | Total or Ave. | 979,333 | 118,800 | 117,052 | 235,852 (24.1) | 509 | 507 | 1,016 (0.1) | 236,868 (24.2) |
| Ramanathapuram | Tiruvadanai | 194,212 | 18,480 | 18,609 | 37,089 (19.1) | 83 | 70 | 153 (0.1) | 37,242 (19.2) |
| | Paramakudi | 151,124 | 23,021 | 22,839 | 45,860 (30.3) | 11 | 9 | 20 (0.0) | 45,880 (30.4) |
| | Kamudi | 101,915 | 9,837 | 9,913 | 19,750 (19.4) | 4 | 3 | 7 (0.0) | 19,757 (19.4) |
| | Mudukalathur | 211,603 | 22,073 | 21,684 | 43,757 (20.7) | 17 | 16 | 33 (0.0) | 43,790 (20.7) |
| | Ramanathapuram | 211,597 | 20,122 | 19,781 | 39,903 (18.9) | 159 | 112 | 271 (0.1) | 40,174 (19.0) |
| | Rameswaram | 23,801 | 200 | 236 | 436 (1.8) | 0 | 0 | 0 (0.0) | 436 (1.8) |
| | Total or Ave. | 894,252 | 93,733 | 93,062 | 186,795 (20.9) | 274 | 210 | 484 (0.1) | 187,279 (20.9) |



## Table 3.1.4 Literate Population in the Rural Areas of Study Area

| District | Name of Taluk | Population in Rural Area | Literate Population in Rural Areas | | |
|---|---|---|---|---|---|
| | | | Male | Female | Total (%) |
| Tiruvallur & Kanchipuram | Gummidipundi | 139,111 | 36,484 | 20,892 | 57,376 (41.2) |
| | Ponneri | 237,333 | 69,325 | 44,483 | 113,808 (48.0) |
| | Uthukottai | 128,063 | 33,888 | 18,944 | 52,832 (41.3) |
| | Tiruvallur | 247,188 | 73,461 | 45,839 | 119,300 (48.3) |
| | Tiruttani | 137,154 | 37,681 | 20,404 | 58,085 (42.4) |
| | Pallipattu | 135,255 | 37,535 | 19,505 | 57,040 (42.2) |
| | Kancheepuram | 199,076 | 57,193 | 33,301 | 90,494 (45.5) |
| | Sriperumbudur | 250,445 | 77,719 | 48,783 | 126,502 (50.5) |
| | Saidapet | 177,752 | 62,891 | 43,579 | 106,470 (59.9) |
| | Chengalpattu | 408,237 | 130,304 | 81,334 | 211,638 (51.8) |
| | Uttiramerur | 111,219 | 31,735 | 18,348 | 50,083 (45.0) |
| | Madurantakam | 220,135 | 61,688 | 37,449 | 99,137 (45.0) |
| | Cheyyur | 174,615 | 42,928 | 24,695 | 67,623 (38.7) |
| | Total or Ave. | 2,565,583 | 752,832 | 457,556 | 1,210,388 (47.2) |
| Sivagangai | Tiruppattur | 190,902 | 55,987 | 35,601 | 91,588 (48.0) |
| | Karaikudi | 99,857 | 30,014 | 19,850 | 49,864 (49.9) |
| | Devaikkottai | 75,090 | 23,560 | 15,710 | 39,270 (52.3) |
| | Sivaganga | 203,058 | 62,593 | 38,080 | 100,673 (49.6) |
| | Manamadurai | 138,391 | 42,516 | 22,456 | 64,972 (46.9) |
| | Ilayankudi | 80,701 | 24,964 | 14,833 | 39,797 (49.3) |
| | Total or Ave. | 787,999 | 239,634 | 146,530 | 386,164 (49.0) |
| Virudunagar | Srivilliputtur | 181,736 | 51,369 | 30,702 | 82,071 (45.2) |
| | Virudhunagar | 142,199 | 43,899 | 25,989 | 69,888 (49.1) |
| | Tiruchuli | 94,042 | 26,976 | 14,196 | 41,172 (43.8) |
| | Aruppukottai | 203,747 | 62,858 | 39,507 | 102,365 (50.2) |
| | Sattur | 216,818 | 63,496 | 38,229 | 101,725 (46.9) |
| | Rajapalayam | 140,791 | 42,875 | 26,437 | 69,312 (49.2) |
| | Total or Ave. | 979,333 | 291,473 | 175,060 | 466,533 (47.6) |
| Ramanathapuram | Tiruvadanai | 194,212 | 62,532 | 38,832 | 101,364 (52.2) |
| | Paramakudi | 151,124 | 45,109 | 25,334 | 70,443 (46.6) |
| | Kamudi | 101,915 | 30,003 | 16,525 | 46,528 (45.7) |
| | Mudukalathur | 211,603 | 58,092 | 33,371 | 91,463 (43.2) |
| | Ramanathapuram | 211,597 | 64,321 | 45,860 | 110,181 (52.1) |
| | Rameswaram | 23,801 | 7,571 | 6,160 | 13,731 (57.7) |
| | Total or Ave. | 894,252 | 267,628 | 166,082 | 433,710 (48.5) |



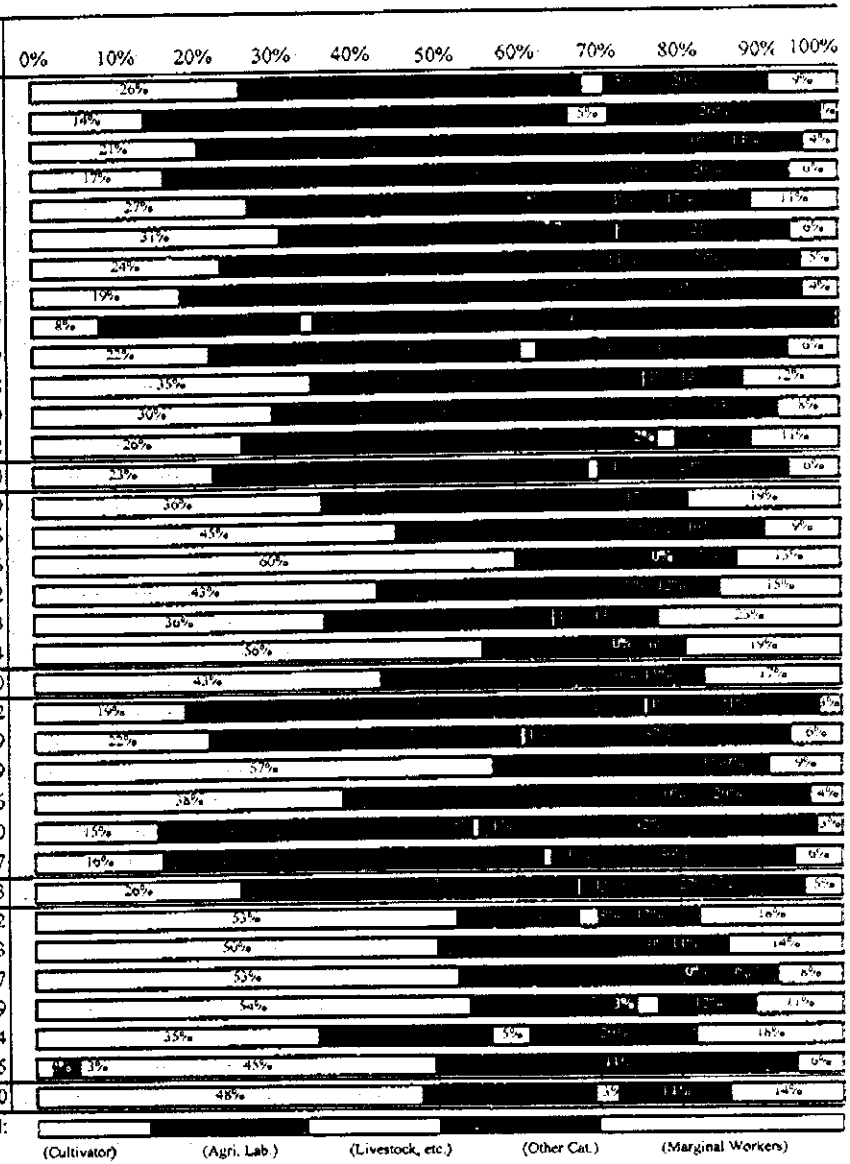
## Table 3.1.5 Summary of Population of Workers in Rural Areas of the Study Area

| District | Name of Taluk | Rural Population | | | Total Workers | | | Percentage to the Rural Population |
|---|---|---|---|---|---|---|---|---|
| | | Male | Female | Total | Male (%) | Female (%) | Total (%) | 0% 10% 20% 30% 40% 50% 60% |
| Tiruvallur & Kanchipuram | Gummidipundi | 70,683 | 68,428 | 139,111 | 40,576 (29.2) | 21,909 (15.7) | 62,514 (44.9) | |
| | Ponneri | 119,926 | 117,407 | 237,333 | 68,131 (28.7) | 28,839 (12.2) | 96,999 (40.9) | |
| | Uthukottai | 64,422 | 63,641 | 128,063 | 38,958 (30.4) | 26,323 (20.6) | 65,311 (51.0) | |
| | Tiruvallur | 124,411 | 122,777 | 247,188 | 69,565 (28.1) | 39,762 (16.1) | 109,355 (44.2) | |
| | Tiruttani | 69,265 | 67,889 | 137,154 | 39,258 (28.6) | 25,797 (18.8) | 65,084 (47.5) | |
| | Pallipattu | 68,410 | 66,845 | 135,255 | 37,530 (27.7) | 21,665 (16.0) | 59,223 (43.8) | |
| | Kancheepuram | 99,670 | 99,406 | 199,076 | 57,191 (28.7) | 38,068 (19.1) | 95,288 (47.9) | |
| | Sriperumbudur | 126,884 | 123,561 | 250,445 | 69,712 (27.8) | 32,760 (13.1) | 102,500 (40.9) | |
| | Saidapet | 91,029 | 86,723 | 177,752 | 48,071 (27.0) | 10,086 (5.7) | 58,184 (32.7) | |
| | Chengalpattu | 208,123 | 200,114 | 408,237 | 115,541 (28.3) | 54,885 (13.4) | 170,454 (41.8) | |
| | Uttiramerur | 56,315 | 54,904 | 111,219 | 31,745 (28.5) | 20,480 (18.4) | 52,254 (47.0) | |
| | Madurantakam | 111,308 | 108,827 | 220,135 | 62,581 (28.4) | 43,041 (19.6) | 105,650 (48.0) | |
| | Cheyyur | 87,908 | 86,707 | 174,615 | 49,838 (28.5) | 34,024 (19.5) | 83,891 (48.0) | |
| | Total | 1,298,354 | 1,267,229 | 2,565,583 | 728,697 (28.4) | 397,639 (15.5) | 1,126,364 (43.9) | |
| Sivagangai | Tiruppattur | 91,942 | 98,960 | 190,902 | 52,075 (27.3) | 45,494 (23.8) | 97,596 (51.1) | |
| | Karaikudi | 48,663 | 51,194 | 99,857 | 27,147 (27.2) | 19,989 (20.0) | 47,163 (47.2) | |
| | Devaikkottai | 36,320 | 38,770 | 75,090 | 21,155 (28.2) | 17,379 (23.1) | 38,562 (51.4) | |
| | Sivaganga | 99,251 | 103,807 | 203,058 | 56,213 (27.7) | 50,162 (24.7) | 106,403 (52.4) | |
| | Manamadurai | 69,358 | 69,033 | 138,391 | 39,907 (28.8) | 34,946 (25.3) | 74,882 (54.1) | |
| | Ilayankudi | 39,576 | 41,125 | 80,701 | 22,796 (28.2) | 20,783 (25.8) | 43,607 (54.0) | |
| | Total | 385,110 | 402,889 | 787,999 | 219,293 (27.8) | 188,753 (24.0) | 408,074 (51.8) | |
| Virudunagar | Srivilliputtur | 91,470 | 90,266 | 181,736 | 53,416 (29.4) | 43,922 (24.2) | 97,367 (53.6) | |
| | Virudhunagar | 71,431 | 70,768 | 142,199 | 40,501 (28.5) | 37,577 (26.4) | 78,106 (54.9) | |
| | Tiruchuli | 46,876 | 47,166 | 94,042 | 27,362 (29.1) | 23,424 (24.9) | 50,815 (54.0) | |
| | Aruppukottai | 101,337 | 102,410 | 203,747 | 58,916 (28.9) | 51,126 (25.1) | 110,071 (54.0) | |
| | Sattur | 107,520 | 109,298 | 216,818 | 63,842 (29.4) | 62,327 (28.7) | 126,198 (58.2) | |
| | Rajapalayam | 70,481 | 70,310 | 140,791 | 41,623 (29.6) | 32,269 (22.9) | 73,922 (52.5) | |
| | Total | 489,115 | 490,218 | 979,333 | 285,660 (29.2) | 250,645 (25.6) | 536,334 (54.8) | |
| Ramanathapuram | Tiruvadanai | 96,031 | 98,181 | 194,212 | 55,594 (28.6) | 42,134 (21.7) | 97,757 (50.3) | |
| | Paramakudi | 74,566 | 76,558 | 151,124 | 43,849 (29.0) | 40,600 (26.9) | 84,478 (55.9) | |
| | Kamudi | 50,915 | 51,000 | 101,915 | 29,804 (29.2) | 26,894 (26.4) | 56,727 (55.7) | |
| | Mudukalathur | 104,909 | 106,694 | 211,603 | 60,232 (28.5) | 49,967 (23.6) | 110,227 (52.1) | |
| | Ramanathapuram | 104,619 | 106,978 | 211,597 | 56,023 (26.5) | 33,619 (15.9) | 89,668 (42.4) | |
| | Rameswaram | 12,180 | 11,621 | 23,801 | 6,172 (25.9) | 937 (3.9) | 7,135 (30.0) | |
| | Total | 443,220 | 451,032 | 894,252 | 251,674 (28.1) | 194,151 (21.7) | 445,853 (49.9) | |

Note: : Male : Female

## Table 3.1.6 Popuation of Workers by Categories in Rural Areas of the Study Area

| District | Name of Taluk | Total Workers | Cultivator | Agri. Labourer | Livestock, etc. | Other Cat. | Marginal Worker |
|---|---|---|---|---|---|---|---|
| Tiruvallur & Kanchipuram | Gummidipundi | 62,485 | 16,294 | 26,479 | 1,806 | 12,499 | 5,407 |
| | Ponneri | 96,970 | 13,700 | 51,013 | 4,895 | 25,218 | 2,144 |
| | Uthukottai | 65,281 | 13,589 | 39,374 | 252 | 9,280 | 2,786 |
| | Tiruvallur | 109,327 | 18,137 | 62,238 | 315 | 22,069 | 6,568 |
| | Tiruttani | 65,055 | 17,634 | 28,747 | 358 | 11,296 | 7,020 |
| | Pallipattu | 59,195 | 18,389 | 24,570 | 372 | 12,343 | 3,521 |
| | Kancheepuram | 95,259 | 22,503 | 45,866 | 518 | 21,935 | 4,437 |
| | Sriperumbudur | 102,472 | 19,034 | 48,259 | 425 | 30,182 | 4,572 |
| | Saidapet | 58,157 | 4,868 | 14,581 | 1,064 | 37,277 | 367 |
| | Chengalpattu | 170,426 | 37,737 | 65,746 | 3,805 | 52,339 | 10,799 |
| | Uttiramerur | 52,225 | 18,178 | 21,331 | 347 | 6,121 | 6,248 |
| | Madurantakam | 105,622 | 31,608 | 52,154 | 401 | 13,430 | 8,029 |
| | Cheyyur | 83,862 | 21,936 | 43,041 | 2,041 | 7,692 | 9,152 |
| | Total | 1,126,336 | 253,607 | 523,399 | 16,599 | 261,681 | 71,050 |
| Sivagangai | Tiruppattur | 97,569 | 35,209 | 32,113 | 375 | 11,513 | 18,359 |
| | Karaikudi | 47,136 | 21,351 | 13,714 | 232 | 7,443 | 4,396 |
| | Devaikkottai | 38,534 | 23,133 | 7,573 | 41 | 2,871 | 4,916 |
| | Sivaganga | 106,375 | 45,581 | 31,707 | 469 | 12,766 | 15,852 |
| | Manamadurai | 74,853 | 27,153 | 20,936 | 501 | 9,420 | 16,843 |
| | Ilayankudi | 43,579 | 24,388 | 7,961 | 75 | 2,811 | 8,344 |
| | Total | 408,046 | 176,815 | 114,004 | 1,693 | 46,824 | 68,710 |
| Virudunagar | Srivilliputtur | 97,338 | 18,379 | 55,132 | 797 | 20,268 | 2,762 |
| | Virudhunagar | 78,078 | 17,034 | 30,126 | 655 | 25,284 | 4,979 |
| | Tiruchuli | 50,786 | 29,025 | 12,688 | 55 | 4,449 | 4,569 |
| | Aruppukottai | 110,042 | 42,359 | 40,537 | 364 | 22,406 | 4,376 |
| | Sattur | 126,169 | 19,422 | 49,197 | 1,211 | 52,369 | 3,970 |
| | Rajapalayam | 73,892 | 11,863 | 34,801 | 883 | 21,988 | 4,357 |
| | Total | 536,305 | 138,082 | 222,481 | 3,965 | 146,764 | 25,013 |
| Ramanathapuram | Tiruvadanai | 97,728 | 51,409 | 14,611 | 2,457 | 12,049 | 17,202 |
| | Paramakudi | 84,449 | 42,416 | 20,967 | 196 | 8,907 | 11,963 |
| | Kamudi | 56,698 | 29,905 | 16,716 | 184 | 5,336 | 4,557 |
| | Mudukalathur | 110,199 | 59,655 | 22,449 | 3,122 | 13,074 | 11,899 |
| | Ramanathapuram | 89,642 | 31,711 | 19,178 | 4,293 | 18,236 | 16,224 |
| | Rameswaram | 7,109 | 150 | 232 | 3,167 | 3,155 | 405 |
| | Total | 445,825 | 215,246 | 94,153 | 13,419 | 60,757 | 62,250 |



## Table 3.2.1 Summary of Climate Data in the Study Area

| Station/Parameter | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mean Monthly Rainfall (mm)** | | | | | | | | | | | | | |
| (Northern Study Area) | | | | | | | | | | | | | |
| Tiruthani | 15.5 | 9.2 | 13.0 | 15.7 | 47.9 | 67.0 | 111.9 | 131.1 | 148.7 | 172.8 | 199.1 | 87.8 | 1,019.7 |
| Nungambakkam | 20.2 | 10.8 | 7.5 | 12.4 | 43.0 | 51.7 | 87.4 | 129.0 | 103.4 | 232.1 | 326.7 | 125.0 | 1,106.6 |
| (Southern Study Area) | | | | | | | | | | | | | |
| Kavalur | 24.9 | 12.9 | 20.6 | 55.2 | 66.1 | 23.8 | 42.5 | 40.4 | 106.3 | 182.9 | 156.6 | 47.3 | 779.5 |
| Karaikudi | 8.4 | 9.0 | 12.1 | 23.5 | 30.8 | 59.7 | 92.6 | 88.4 | 125.6 | 136.7 | 125.1 | 85.3 | 797.2 |
| **Mean Temperature (°C)** | | | | | | | | | | | | | |
| (Northern Study Area) | | | | | | | | | | | | | |
| Tiruthani | 24.3 | 25.9 | 28.5 | 31.6 | 33.6 | 31.9 | 30.1 | 29.5 | 29.1 | 27.8 | 25.4 | 24.4 | 28.5 |
| Nungambakkam | 24.9 | 26.2 | 28.2 | 30.5 | 32.4 | 32.2 | 30.6 | 30.1 | 29.6 | 28.3 | 26.2 | 25.2 | 28.7 |
| (Southern Study Area) | | | | | | | | | | | | | |
| Kavalur | 25.5 | 27.1 | 29.6 | 31.5 | 32.1 | 31.3 | 31.1 | 31.1 | 30.3 | 28.8 | 26.9 | 26.0 | 29.3 |
| Karaikudi | 25.6 | 27.2 | 29.6 | 31.6 | 32.3 | 31.5 | 30.7 | 30.4 | 30.1 | 28.6 | 26.9 | 25.9 | 29.2 |
| **Mean Relative Humidity (%)** | | | | | | | | | | | | | |
| (Northern Study Area) | | | | | | | | | | | | | |
| Tiruthani | 70.7 | 68.7 | 63.1 | 60.9 | 53.1 | 56.2 | 65.2 | 66.2 | 70.5 | 73.2 | 77.4 | 75.1 | 66.7 |
| Nungambakkam | 73.9 | 73.6 | 73.1 | 72.2 | 67.5 | 64 | 69.3 | 70.3 | 75.8 | 78.1 | 79.1 | 77.7 | 72.9 |
| (Southern Study Area) | | | | | | | | | | | | | |
| Kavalur | 62.5 | 58.7 | 57.3 | 59.6 | 59.5 | 57.1 | 56.5 | 55.5 | 62.1 | 69 | 73.4 | 69.8 | 61.8 |
| Karaikudi | 71.8 | 67 | 67.6 | 66.9 | 66.7 | 63.9 | 63.6 | 66.9 | 70.7 | 76.6 | 78.6 | 77.5 | 69.8 |
| **Mean Sunshine Hours** | | | | | | | | | | | | | |
| (Northern Study Area) | | | | | | | | | | | | | |
| Tiruthani | 8.3 | 9.5 | 9.9 | 10 | 9.2 | 6.1 | 5.2 | 6.2 | 6.1 | 6.5 | 6.3 | 6.9 | 7.5 |
| Nungambakkam | 8.6 | 9.7 | 9.6 | 9.7 | 9.2 | 6.7 | 5.8 | 6.2 | 6.6 | 6.6 | 6.2 | 6.8 | 7.6 |
| (Southern Study Area) | | | | | | | | | | | | | |
| Kavalur | 8.2 | 9.2 | 8.9 | 8.5 | 7.9 | 6.4 | 6 | 6.3 | 6.5 | 6.2 | 6.2 | 6.7 | 7.3 |
| Karaikudi | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Average Wind Run (km/day)** | | | | | | | | | | | | | |
| (Northern Study Area) | | | | | | | | | | | | | |
| Tiruthani | 103 | 104 | 133 | 145 | 177 | 229 | 190 | 177 | 138 | 86 | 91 | 111 | 140 |
| Nungambakkam | 115 | 121 | 143 | 168 | 193 | 209 | 173 | 168 | 144 | 112 | 134 | 142 | 152 |
| (Southern Study Area) | | | | | | | | | | | | | |
| Kavalur | 109 | 96 | 95 | 98 | 102 | 156 | 143 | 159 | 111 | 79 | 73 | 108 | 111 |
| Karaikudi | 159 | 149 | 152 | 161 | 181 | 213 | 175 | 175 | 151 | 119 | 137 | 158 | 161 |

Note: Elevation of the stations are as follows:

| | |
|---|---|
| Tiruthani | : 87 m |
| Nungambakkam | : 6 m |
| Kavalur | : 110 m |
| Karaikudi | : 86 m |

## Table 3.2.2 River Basins in and around the Study Areas

| Study Area | Major River | Tributary | Sub-tributary |
|---|---|---|---|
| Northern Study Area | Araniyaru | Ilam Klavi | |
| | | Nagari | |
| | | Nandiyaru | |
| | | Akkur | |
| | Cooum | | |
| | Adayar | | |
| | Palar | Kallar | |
| | | Malattar | Goddarvanka |
| | | | Goddarvanka |
| | | Goundinya Nadhi | Goddar |
| | | Punniyathirtha Nadhi | Gundakalkan Ar. |
| | | | Uttrakaveri Ar. |
| | | Malaikanar R. | |
| | | Poiney | |
| | | Cheyyar | Karavanar R. |
| | | | Kattu Ar |
| | | | Kamandalar |
| | | | Nandiyar |
| | | | Kalavai Maduvu |
| | | Kiliyaru | |
| | Ongur R. | | |
| Southern Study Area | Vellar | | |
| | Koluvanaru | | |
| | Pambar | | |
| | Manimuthar | Virusuli R. | Palaru |
| | | Thirumanimuthar | |
| | Kottakaraiaru | Saruganiar | |
| | Vaigai | Kottakudiar | |
| | | Suruliar | |
| | | Mavuttuodai | |
| | | Varaha Nadhi | |
| | | Manjalar | Maruda Nadhi |
| | Uttarkosamangaiaru | | |
| | Gundar | Marattanaru | Kanalodai |
| | | Vegavathi | Paralayaru |
| | Vembaru | | |
| | Vaipparu | Sevalaperi | |
| | | Nichaba Nadhi | Deviyaru |
| | | Arjuna Nadhi | Mannarukottai |

## Table 3.2.3 Block-wise Geology

| Northern Study Area | | |
|---|---|---|
| Union Name | Taluk Name | Geology |
| **Tiruvallur District** | | |
| 1. Poonamallee | Sriperumbudur | Contact |
| 2. Villivakkam | Saidapet | Contact |
| 3. Puzhal(Madhavaram) | Saidapet | Sedimentary |
| 4. Minjur | Ponneri | Sedimentary |
| 5. Sholavaram | Ponneri | Contact |
| 6. Gummidipoondi | Gunidipoondi | Sedimentary |
| 7. Thiruvallur | Thiruvallur | Contact |
| 8. Kadambathur | Thiruvallur | Sedimentary |
| 9. Poondi | Uthukottai | Sedimentary |
| 10. Ellapuram | Uthukottai | Sedimentary |
| 11. Tiruthani | Tiruthani | Hard Rock |
| 12. Tiruvelangadu | Tiruthani | Hard Rock |
| 13. R. K. Pet | Pallipet | Sedimentary |
| 14. Pallipet | Pallipet | Sedimentary |
| **Kanchipuram District** | | |
| 1. Kancheepuram | Kancheepuram | Sedimentary |
| 2. Walajabad | Uthiramerur | Sedimentary |
| 3. Uthiramerur | Uthiramerur | Hard Rock |
| 4. Thiruperumbudur | Sriperumbudur | Sedimentary |
| 5. Kundrathur | Sriperumbudur | Contact |
| 6. Kattankulathur | Chingleput | Hard Rock |
| 7. Tirupporur | Chingleput | -do- |
| 8. Thirukalukundram | Chingleput | -do- |
| 9. Maduranthagam | Maduranthagam | -do- |
| 10. Acharappakkam | Maduranthagam | -do- |
| 11. Chithamur | Cheyyur | -do- |
| 12. Lathur | Cheyyur | -do- |
| 13. St. Thomas Mount | Saidapet | -do- |

| Southern Study Area | | |
|---|---|---|
| Union Name | Taluk Name | Geology |
| **Sivagangai District** | | |
| 1. Sivagangai | Sivagangai | Contact |
| 2. Kalyarkoil | Sivagangai | Sedimentary |
| 3. Manamadurai | Manamadurai | Contact |
| 4. Thirupuvanam | Manamadurai | Contact |
| 5. Illayangudi | Illayankudi | Sedimentary |
| 6. Devakottai | Devakottai | -do- |
| 7. Kannangudi | Devaikottai | -do- |
| 8. Sakkottai | Karaikudi | -do- |
| 9. Kallal | Karaikudi | -do- |
| 10. Tirupathur | Thirupathur | Hard Rock |
| 11. Singampuneri | Thirupathur | -do- |
| 12. S. Pudur | Thirupathur | -do- |
| **Ramanathapuram District** | | |
| 1. Ramanathapuram | Ramanathapuram | Sedimntary |
| 2. Tiruppullani | Ramanathapuram | -do- |
| 3. Mandapam | Rameswaram | -do- |
| 4. Thiruvadanai | Thiruvadanai | -do- |
| 5. Rajasinga Mangalam | Thiruvadanai | -do- |
| 6. Paramakudi | Parmakudi | -do- |
| 7. Bohalpur | Paramakudi | -do- |
| 8. Nainarkoil | Paramakudi | -do- |
| 9. Mudhukulathur | Mudukulathur | -do- |
| 10. Kaladi | Mudukulathur | -do- |
| 11. Kamudhi | Kamudhi | Contact |
| **Virudunagar District** | | |
| 1. Arupukkottai | Aruppukottai | Hard Rock |
| 2. Kariapatti | Aruppukottai | -do- |
| 3. Thiruchuli | Thiruchuli | -do- |
| 4. Narikudi | Thiruchuli | -do- |
| 5. Virudhunagar | Virudhunagar | -do- |
| 6. Sattur | Sattur | -do- |
| 7. Sivakasi | Sattur | -do- |
| 8. Vembakottai | Sattur | -do- |
| 9. Srivilliputhur | Srivilliputhur | -do- |
| 10. Wtrap | Srivilliputhur | -do- |
| 11. Rajapalayam | Rajapalayam | -do- |

## Table 3.2.4 Block-wise Groundwater Potential

### Northern Study Area

| Union Name/Category | Ground-water Potential (MCM) | Draft (MCM) | Balance (MCM) | Remarks |
|---|---|---|---|---|
| **Tiruvallur District** | | | | |
| 1. Poonamallee | 51.60 | 41.51 | 10.09 | Grey |
| 2. Villivakkam | 53.16 | 36.99 | 16.17 | Grey |
| 3. Puzhal (Madhavaram) | 19.35 | 24.21 | -4.86 | Over Exploited |
| 4. Minjur | 55.56 | 96.42 | -40.86 | Over Exploited |
| 5. Sholavaram | 69.28 | 60.78 | 8.50 | Dark |
| 6. Gummidipoondi | 98.11 | 15.78 | 82.33 | White |
| 7. Thiruvallur | 54.58 | 63.88 | -9.30 | Over Exploited |
| 8. Kadambathur | 61.60 | 15.80 | 45.80 | White |
| 9. Poondi | 66.26 | 93.24 | -26.98 | Over Exploited |
| 10. Ellapuram | 54.71 | 25.74 | 28.97 | White |
| 11. Tiruthani | 47.71 | 31.13 | 16.58 | Grey |
| 12. Tiruvelangadu | 33.37 | 36.07 | -2.70 | Over Exploited |
| 13. R. K. Pet | 54.25 | 57.40 | -3.15 | Over Exploited |
| 14. Pallipet | 40.52 | 22.24 | 18.28 | White |
| **Kanchipuram District** | | | | |
| 1. Kancheepuram | 87.12 | 45.69 | 41.43 | White |
| 2. Walajabad | 102.66 | 28.28 | 74.38 | -do- |
| 3. Uthiramerur | 116.22 | 70.64 | 45.58 | -do- |
| 4. Thiruperumbudur | 105.40 | 20.72 | 84.68 | -do- |
| 5. Kundrathur | 83.50 | 37.48 | 46.02 | -do- |
| 6. Kattankulathur | 95.68 | 52.02 | 43.66 | -do- |
| 7. Tirupporur | 50.96 | 21.07 | 29.89 | -do- |
| 8. Thirukalukundram | 69.29 | 42.22 | 27.07 | -do- |
| 9. Maduranthagam | 158.44 | 109.02 | 49.42 | Grey |
| 10. Acharappakkam | 83.58 | 12.58 | 71.00 | White |
| 11. Chithamur | 78.53 | 38.63 | 39.90 | White |
| 12. Lathur | 13.22 | 9.55 | 3.67 | Grey |
| 13. St. T. Mount | 24.68 | 7.97 | 16.71 | White |

### Southern Study Area

| Union Name/Category | Ground-water Potential (MCM) | Draft (MCM) | Balance (MCM) | Remarks |
|---|---|---|---|---|
| **Sivagngai District** | | | | |
| 1. Sivagangai | 72.20 | 12.52 | 59.68 | White |
| 2. Kalyarkoil | 26.86 | 4.02 | 22.84 | -do- |
| 3. Manamadurai | 42.08 | 8.18 | 33.90 | -do- |
| 4. Thirupuvanam | 74.63 | 4.37 | 70.26 | -do- |
| 5. Illayangudi | 69.02 | 6.79 | 62.23 | -do- |
| 6. Devakottai | 83.30 | 8.84 | 74.46 | -do- |
| 7. Kannangudi | 47.06 | 1.61 | 45.45 | -do- |
| 8. Sakkottai | 53.38 | 3.35 | 50.03 | -do- |
| 9. Kallal | 58.22 | 5.11 | 53.11 | -do- |
| 10. Tirupathur | 53.69 | 10.30 | 43.39 | -do- |
| 11. Singampuneri | 60.08 | 15.27 | 44.81 | -do- |
| 12. S. Pudur | 0.00 | 0.00 | 0.00 | -do- |
| **Ramanathapuram District** | | | | |
| 1. Ramanathapuram | 19.53 | 0.28 | 19.25 | White |
| 2. Tiruppullani | 10.87 | 0.96 | 9.91 | -do- |
| 3. Mandapam | 10.98 | 1.51 | 9.47 | -do- |
| 4. Thiruvadanai | 12.29 | 0.06 | 12.23 | -do- |
| 5. Rajasinga Mangalam | 7.89 | 0.07 | 7.82 | -do- |
| 6. Paramakudi | 16.56 | 0.60 | 15.96 | -do- |
| 7. Bohalpur | 24.43 | 0.47 | 23.96 | -do- |
| 8. Nainarkoil | 7.01 | 0.20 | 6.81 | -do- |
| 9. Mudhukulathur | 20.17 | 1.76 | 18.41 | -do- |
| 10. Kaladi | 12.75 | 0.43 | 12.32 | -do- |
| 11. Kamudhi | 49.68 | 7.68 | 42.00 | -do- |
| **Virudunagar District** | | | | |
| 1. Arupukkottai | 44.51 | 17.21 | 27.30 | White |
| 2. Kariapatti | 66.76 | 14.74 | 52.02 | -do- |
| 3. Thiruchuli | 63.09 | 16.97 | 46.12 | -do- |
| 4. Narikudi | 84.35 | 4.02 | 80.33 | -do- |
| 5. Virudhunagar | 48.37 | 24.75 | 23.62 | -do- |
| 6. Sattur | 50.82 | 19.17 | 31.65 | -do- |
| 7. Sivakasi | 51.94 | 27.79 | 24.15 | -do- |
| 8. Vembakottai | 57.74 | 24.38 | 33.36 | -do- |
| 9. Srivilliputhur | 61.21 | 43.70 | 17.51 | Grey |
| 10. Watrap | 64.65 | 49.06 | 15.59 | Grey |
| 11. Rajapalayam | 91.60 | 85.97 | 5.63 | Dark |

## Table 3.2.5 National Parks and Sanctuaries in Study Area

| Name | Details | |
|---|---|---|
| Arignar Anna Zoological Park | Location: | 32 km from Chennai City on the eastern side of the Grand Southern Trunk Road in the Vandalur Reserved Forest of Chengai Anna District. |
| | Area: | 510 ha |
| | Forest type: | Dry deciduous and dry ever green scrub. |
| | Mammals found: | Mammals, birds and reptiles are displayed in open moat type enclosures. More than 100 numbers of 168 species of mammals, Aves (birds) and reptiles are displayed. |
| | Annual rainfall: | 1,400 mm |
| Pulicat Lake Birds Sanctuary | Location: | Chengai Anna District bordering Andhra Pradesh |
| | Area: | 15,367 ha. |
| | Avi Fauna found: | Flamingoes, a variety of ducks, osprey, avocet, cormorants, herons, spoonbills, egrets, terns, gulls and other migratory birds of coastal habitats. |
| | Annual rainfall: | 1,100 mm |
| Kanjiram-kulam, Chitrangudi and Vettangudi Patti Water Bird Sanctuary | Location: | Near Mudukulathur in Ramanathapuram District |
| | Area: | 104 ha, 48 ha, and 38 ha, respectively. |
| | Forest type: | Lake with groves of trees |
| | Avi fauna: | Cormorants, egrets, herons, teals, other ducks, pelicans white storks, painted storks |
| | Annual Rainfall: | 715.2 mm |
| Srivilliputhur Grizzled Squirrel Wild Life Sanctuary | Location: | Kamarajar District - 45 km from Vidudunagar |
| | Area: | 48,520 ha. |
| | Forest type: | Mainly dry deciduous with patches of tropical ever green forests and green land |
| | Animals found: | Grizzled giant squirrel, flying squirrel, tree shrew, elephant, lion tailed macaque, Nilgris Tahr, Mouse deer, barking deer, many species of birds. |
| | Annual rainfall: | 849.1 mm |
| Vedanthangal and Karikili Bird Sanctuary | Location: | Vedanthangal Anna District - 86 km from Chennai Karikili-Anna District - 90 km from Chennai |
| | Area: | Vedanthangal - 30 ha |
| | Karikili: | 61 ha and a belt of 5 km width around |
| | Forest type: | A tank having a compact grove of Barringtonia and Acacia nilotica trees, dry ever green scrub and thorn forests. |
| | Avi Fauna found: | These sanctuaries are famous for their breeding herorry including cormorants, egrets, grey heron, open billed stork, darter, spoonbill, white ebbs, night herons, grebes, grey pelican etc. Many migratory birds like garganey teals, shovelur, pintails, stilts, sand pipers etc. visit the sanctuary in winter. A variety of resident birds like coots, moorhen and terns can also be seen. Vedenthagal is the oldest bird sanctuary in the country. |
| | Annual rainfall: | 1,200 mm |
| Guindy National Park | Location: | Adjacent to the Raj Bhavan in the South Chennai and is the smallest National Park in the Country. |
| | Area: | 282 ha. |
| | Forest Type: | Dry ever green scrub and thorn forests |
| | Animals found: | Black buck, chiral, jackal, pangolin and a variety of birds |
| | Annual rainfall: | about 1,200 mm |
| Gulf of Mannar Marine National Park | Location: | Located in the areas of districts of Ramanathapuram and Chidambaranar Districts |
| | Area: | 623 ha (21 Islands) |
| | Marine Species: | Characteristics tropical flora and fauna of coral reefs, dugong turtles, Dolphins and Balano glossus. |
| | Annual Rainfall: | about 900 mm |

## Table 3.3.1 Land Use and Irrigated Area in the Study Area

### (1) Land Use of the Study Area 1991-92

(Unit : ha)

| District | Total Area | Forest | Barren & Uncultivable | Land put to non-agriculture | Cultivable Waste | Permanent Pasture other grazing land | Miscellaneous tree crops excluding groves in net area sown | Current Fallow | Other fallow lands | Net Area sown | Area sown more than once | Total Cropped area |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tiruvallur & Kanchipura | 785,453 | 43,592 | 28,912 | 210,292 | 19,773 | 25,001 | 14, 907 | 77,694 | 36,558 | 328,724 | 91,956 | 420,680 |
| Ramanathapuram | 423,344 | 4,488 | 4,961 | 81,654 | 5,755 | 851 | 4,341 | 82,213 | 37,550 | 201,531 | 418 | 201,949 |
| Sivaganga | 431,211 | 34,237 | 4,477 | 66,184 | 6,941 | 904 | 1,629 | 51,952 | 83,390 | 181,197 | 5,028 | 186,225 |
| Virdunagar | 404,526 | 21,806 | 4,183 | 108,445 | 17,643 | 1,292 | 6,738 | 26,539 | 89,717 | 128,163 | 132 | 128,295 |
| Southern Study Area Tota | 1,259,081 | 60,531 | 13,621 | 256,283 | 30,339 | 3,047 | 12,708 | 160,704 | 210,657 | 510,891 | 5,578 | 516,469 |
| Study Area Total | 2,044,534 | 104,123 | 42,533 | 466,575 | 50,112 | 28,048 | 27,615 | 238,398 | 247,215 | 839,615 | 97,534 | 937,149 |
| State Total | 13,018,955 | 2,147,149 | 507,291 | 1,852,752 | 311,015 | 122,980 | 226,811 | 1,061,253 | 1,063,803 | 5,725,901 | 1,251,228 | 6,977,129 |
| Share in State | 100.0% | 16.5% | 3.9% | 14.2% | 2.4% | 0.9% | 1.7% | 8.2% | 8.2% | 44.0% | 9.6% | 53.6% |
| Weight of the Study Area | 15.7% | 0.8% | 0.3% | 3.6% | 0.4% | 0.2% | 0.2% | 1.8% | 1.9% | 6.4% | 0.7% | 7.2% |
| Share in the Study Area | 100.0% | 5.1% | 2.1% | 22.8% | 2.5% | 1.4% | 1.4% | 11.7% | 12.1% | 41.1% | 4.8% | 45.8% |

Source : Agrostat 94, Directorate of Agriculture

### (2) Cultivation Area and Irrigation Ratio in the Study Area

| District | Gross Area | | | Net Area | | | Net/Gross Area Ratio | |
|---|---|---|---|---|---|---|---|---|
| | Irrigated(ha) (1) | Sown(ha) (2) | Irrigation Ratio (3)=(1)/(2) | Irrigated(ha) (4) | Sown(ha) (5) | Irrigation Ratio (6)=(4)/(5) | Irrigated (7) | Sown (8) |
| Tiruvallur & Kanchipuram | 327,544 | 420,680 | 77.9% | 244,067 | 328,724 | 74.2% | 75% | 78% |
| Ramanathapuram | 66,730 | 201,949 | 33.0% | 66,730 | 201,531 | 33.1% | 100% | 100% |
| Sivaganga | 79,641 | 128,295 | 62.1% | 79,509 | 128,163 | 62.0% | 100% | 100% |
| Virdunagar | 59,032 | 186,225 | 31.7% | 54,361 | 181,758 | 29.9% | 92% | 98% |
| Southern Study Area | 205,403 | 516,469 | 39.8% | 200,600 | 511,452 | 39.2% | 98% | 99% |
| Study Area Total | 532,947 | 937,149 | 56.9% | 444,667 | 840,176 | 52.9% | 83% | 90% |
| State Total | 3,256,794 | 6,977,129 | 46.7% | 2,605,188 | 5,725,901 | 45.5% | 80% | 82% |
| Share of the Study Area | 16.4% | 13.4% | | 17.1% | 14.7% | | | |
| Share in State Total | 25.0% | 53.6% | | 20.0% | 44.0% | | | |
| Share in the Study Area | 26.1% | 45.8% | | 21.7% | 41.1% | | | |

Source : Agrostat 94, Directorate of Agriculture

## Table 3.3.2 Crop Production under Irrigation/Non-irrigation in the Study Area and the State in 1992 - 93 ( 1/3 )

| Crop | Study area and State (District) | Area (ha) | | | | Production(ton) | | | Yield(kg/ha) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Irrigated (A) | Non-Irrigated | Total (B) | A/B (%) | Irrigated | Non-Irrigated | Total | Irrigated (A) | Non-Irrigated(B) | Total | A/B (%) |
| Paddy (in rice) | Tiruvallur & Kanchipuram | 218,820 | 18,253 | 237,073 | 92 | | | 729,920 | | | 3,079 | |
| | Ramanathapuram | 57,680 | 88,660 | 146,340 | 39 | | | 224,910 | | | 1,537 | |
| | Virudunagar | 32,088 | 2,180 | 34,268 | 94 | | | 108,690 | | | 3,172 | |
| | Sivagangai | 79,619 | 17,445 | 97,064 | 82 | | | 257,350 | | | 2,651 | |
| | Sub-total | 388,207 | 126,538 | 514,745 | 75 | | | 1,320,870 | | | 2,566 | |
| | STATE | 2,016,087 | 168,313 | 2,184,400 | 92 | | | 6,805,720 | | | 3,116 | |
| Cholam | Tiruvallur & Kanchipuram | 221 | 37 | 258 | 86 | 410 | 30 | 440 | 1,855 | 811 | 1,705 | 229 |
| | Ramanathapuram | 22 | 3,112 | 3,134 | 1 | 40 | 2,910 | 2,950 | 1,818 | 935 | 941 | 194 |
| | Virudunagar | 248 | 4,677 | 4,925 | 5 | 460 | 8,860 | 9,320 | 1,855 | 1,894 | 1,892 | 98 |
| | Sivagangai | 83 | 284 | 367 | 23 | 150 | 270 | 420 | 1,807 | 951 | 1,144 | 190 |
| | Sub-total | 574 | 8,110 | 8,684 | 7 | 1,060 | 12,070 | 13,130 | 1,847 | 1,488 | 1,512 | 124 |
| | STATE | 36,589 | 447,634 | 484,223 | 8 | 67,620 | 418,550 | 486,170 | 1,848 | 935 | 1,004 | 198 |
| Cumbu | Tiruvallur & Kanchipuram | 1,107 | 285 | 1,392 | 80 | 2,460 | 290 | 2,750 | 2,222 | 1,018 | 1,976 | 218 |
| | Ramanathapuram | 141 | 1,615 | 1,759 | 8 | 350 | 1,510 | 1,860 | 2,431 | 935 | 1,057 | 260 |
| | Virudunagar | 563 | 10,867 | 11,430 | 5 | 1,340 | 14,050 | 15,390 | 2,380 | 1,293 | 1,346 | 184 |
| | Sivagangai | 25 | 160 | 185 | 14 | 60 | 160 | 220 | 2,400 | 1,000 | 1,189 | 240 |
| | Sub-total | 1,839 | 12,927 | 14,766 | 12 | 4,210 | 16,010 | 20,220 | 2,289 | 1,238 | 1,369 | 185 |
| | STATE | 20,312 | 199,242 | 219,554 | 9 | 49,050 | 202,180 | 251,230 | 2,415 | 1,015 | 1,144 | 238 |
| Maize | Tiruvallur & Kanchipuram | 0 | 0 | 0 | | 0 | 0 | 0 | -- | -- | -- | -- |
| | Ramanathapuram | 0 | 0 | 0 | | 0 | 0 | 0 | -- | -- | -- | -- |
| | Virudunagar | 795 | 600 | 1,395 | 57 | | | 2,760 | | | 1,978 | |
| | Sivagangai | 0 | 0 | 0 | | 0 | 0 | 0 | -- | -- | -- | -- |
| | Sub-total | 795 | 600 | 1,395 | 57 | | | 2,760 | | | 1,978 | |
| | STATE | 21,428 | 21,910 | 43,338 | 49 | | | 70,420 | | | 1,625 | |
| Ragi | Tiruvallur & Kanchipuram | 3,814 | 2,459 | 6,273 | 61 | 6,150 | 2,740 | 8,890 | 1,612 | 1,114 | 1,417 | 145 |
| | Ramanathapuram | 493 | 3,263 | 3,756 | 13 | 720 | 2,770 | 3,490 | 1,460 | 849 | 929 | 172 |
| | Virudunagar | 2,507 | 2 | 2,509 | 100 | 6,260 | | 6,260 | 2,497 | | 2,495 | |
| | Sivagangai | 633 | 592 | 1,225 | 52 | 1,620 | 650 | 2,270 | 2,559 | 1,098 | 1,853 | 233 |
| | Sub-total | 7,447 | 6,316 | 13,763 | 54 | 14,750 | 6,160 | 20,910 | 1,981 | 975 | 1,519 | 203 |
| | STATE | 52,075 | 98,471 | 150,546 | 35 | 149,110 | 141,890 | 291,000 | 2,863 | 1,441 | 1,933 | 199 |
| Other Cereals | Tiruvallur & Kanchipuram | 1 | 69 | 70 | 1 | | | 90 | | | 1,286 | |
| | Ramanathapuram | 32 | 1,245 | 1,277 | 3 | | | 760 | | | 595 | |
| | Virudunagar | 18 | 4,447 | 4,465 | 0 | | | 2,690 | | | 602 | |
| | Sivagangai | 33 | 534 | 567 | 6 | | | 430 | | | 758 | |
| | Sub-total | 84 | 6,295 | 6,379 | 1 | | | 3,970 | | | 622 | |
| | STATE | 261 | 123,720 | 123,981 | 0 | | | 110,860 | | | 894 | |
| Bengal gram | Tiruvallur & Kanchipuram | 0 | 0 | 0 | -- | 0 | 0 | 0 | -- | -- | -- | -- |
| | Ramanathapuram | 0 | 0 | 0 | -- | 0 | 0 | 0 | -- | -- | -- | -- |
| | Virudunagar | 1 | 198 | 199 | 1 | | | 100 | | | 503 | |
| | Sivagangai | 0 | 0 | 0 | -- | 0 | 0 | 0 | -- | -- | -- | -- |
| | Sub-total | 1 | 198 | 199 | 1 | | | 100 | | | 503 | |
| | STATE | 652 | 5,992 | 6,644 | 10 | | | 4,170 | | | 628 | |
| Green gram | Tiruvallur & Kanchipuram | 2,341 | 2,394 | 4,735 | 49 | | | 2,160 | | | 456 | |
| | Ramanathapuram | 7 | 320 | 327 | 2 | | | 130 | | | 398 | |
| | Virudunagar | 756 | 5,614 | 6,370 | 12 | | | 3,750 | | | 589 | |
| | Sivagangai | 7 | 322 | 329 | 2 | | | 150 | | | 456 | |
| | Sub-total | 3,111 | 8,650 | 11,761 | 26 | | | 6,190 | | | 526 | |
| | STATE | 9,043 | 114,318 | 123,361 | 7 | | | 56,260 | | | 456 | |
| Red gram | Tiruvallur & Kanchipuram | 114 | 1,038 | 1,152 | 10 | | | 690 | | | 599 | |
| | Ramanathapuram | 103 | 38 | 141 | 73 | | | 80 | | | 567 | |
| | Virudunagar | 3 | 1,896 | 1,899 | 0 | | | 1,130 | | | 595 | |
| | Sivagangai | 40 | 906 | 946 | 4 | | | 570 | | | 603 | |
| | Sub-total | 260 | 3,878 | 4,138 | 6 | | | 2,470 | | | 597 | |
| | STATE | 1,518 | 105,152 | 106,670 | 1 | | | 63,720 | | | 597 | |
| Black gram | Tiruvallur & Kanchipuram | 3,338 | 3,981 | 7,319 | 46 | | | 3,800 | | | 519 | |
| | Ramanathapuram | 0 | 4,784 | 4,784 | 0 | 0 | 2,490 | 2,490 | -- | 520 | 520 | |
| | Virudunagar | 91 | 9,149 | 9,240 | 1 | | | 5,080 | | | 550 | |
| | Sivagangai | 78 | 989 | 1,067 | 7 | | | 550 | | | 515 | |
| | Sub-total | 3,507 | 18,903 | 22,410 | 16 | | | 11,920 | | | 532 | |
| | STATE | 25,336 | 242,435 | 267,771 | 9 | | | 139,200 | | | 520 | |
| Horse gram | Tiruvallur & Kanchipuram | 24 | 618 | 642 | 4 | | | 300 | | | 467 | |
| | Ramanathapuram | 0 | 39 | 39 | 0 | 0 | 20 | 20 | -- | 513 | 513 | |
| | Virudunagar | 0 | 151 | 151 | 0 | 0 | 70 | 70 | -- | 464 | 464 | |
| | Sivagangai | 9 | 301 | 310 | 3 | | | 140 | | | 452 | |
| | Sub-total | 33 | 1,109 | 1,142 | 3 | | | 530 | | | 464 | |
| | STATE | 408 | 120,612 | 121,020 | 0 | | | 56,080 | | | 463 | |

Source : Season and Crop Report of Tamil Nadu, Government Central Press, Madras

## Table 3.3.2 Crop Production under Irrigation/Non-irrigation in the Study Area and the State in 1992 - 93 ( 2/3 )

| Crop | Study area and State (District) | Area (ha) | | | | Production(ton) | | | Yield(kg/ha) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Irrigated (A) | Non-Irrigated | Total (B) | A/B (%) | Irrigated | Non-Irrigated | Total | Irrigated (A) | Non-Irrigated(B) | Total | A/B (%) |
| Other Pulses | Tiruvallur & Kanchipuram | 738 | 869 | 1,607 | 46 | | | 390 | | | 243 | |
| | Ramanathapuram | 12 | 527 | 539 | 2 | | | 100 | | | 186 | |
| | Virudunagar | 15 | 3,308 | 3,323 | 0 | | | 610 | | | 193 | |
| | Sivagangai | 18 | 861 | 879 | 2 | | | 170 | | | 193 | |
| | Sub-total | 783 | 5,565 | 6,348 | 12 | | | 1,300 | | | 205 | |
| | STATE | 7,236 | 106,262 | 113,498 | 6 | | | 23,200 | | | 204 | |
| Chillies | Tiruvallur & Kanchipuram | 1,349 | 23 | 1,372 | 98 | | | 820 | | | 598 | |
| | Ramanathapuram | 3,585 | 13,482 | 17,067 | 21 | | | 5,150 | | | 302 | |
| | Virudunagar | 5,945 | 0 | 5,945 | 100 | | | 3,040 | | | 511 | |
| | Sivagangai | 2,793 | 2,577 | 5,370 | 52 | | | 2,750 | | | 512 | |
| | Sub-total | 13,672 | 16,082 | 29,754 | 46 | | | 11,760 | | | 395 | |
| | STATE | 51,022 | 35,467 | 86,489 | 59 | | | 45,730 | | | 529 | |
| Turmeric | Tiruvallur & Kanchipuram | 7 | 0 | 7 | 100 | | | 40 | | | 5,714 | |
| | Ramanathapuram | 0 | 2 | 2 | 0 | 0 | 10 | 10 | -- | 5,000 | 5,000 | -- |
| | Virudunagar | 0 | 0 | 0 | -- | 0 | 0 | | -- | -- | -- | -- |
| | Sivagangai | 1 | 2 | 3 | 33 | | | 10 | | | 3,333 | |
| | Sub-total | 8 | 4 | 12 | 67 | | | 60 | | | 5,000 | |
| | STATE | 15,726 | 58 | 15,784 | 100 | | | 83,220 | | | 5,272 | |
| Other Spices | Tiruvallur & Kanchipuram | 0 | 111 | 111 | 0 | 0 | 400 | 400 | -- | 3,604 | 3,604 | -- |
| | Ramanathapuram | 18 | 2,650 | 2,668 | 1 | | | 810 | | | 304 | |
| | Virudunagar | 33 | 6,064 | 6,097 | 1 | | | 1,320 | | | 216 | |
| | Sivagangai | 10 | 459 | 469 | 2 | | | 1,100 | | | 2,345 | |
| | Sub-total | 61 | 9,284 | 9,345 | 1 | | | 3,630 | | | 388 | |
| | STATE | 3,054 | 72,374 | 75,428 | 4 | | | 75,530 | | | 1,001 | |
| Sugarcane | Tiruvallur & Kanchipuram | 11,462 | 0 | 11,462 | 100 | 1,243,050 | | | 108,450 | -- | | -- |
| | Ramanathapuram | 46 | 0 | 46 | 100 | 4,920 | | | 106,957 | -- | | -- |
| | Virudunagar | 3,613 | 0 | 3,613 | 100 | 386,460 | | | 106,964 | -- | | -- |
| | Sivagangai | 3,163 | 0 | 3,163 | 100 | 300,170 | | | 94,900 | -- | | -- |
| | Sub-total | 18,284 | 0 | 18,284 | 100 | 1,934,600 | | | 105,808 | -- | | -- |
| | STATE | 215,581 | 47 | 215,628 | 100 | 23,064,260 | | | 106,987 | -- | | -- |
| Other Sugar Crops | Tiruvallur & Kanchipuram | 0 | 449 | 449 | 0 | 0 | | | -- | | 0 | -- |
| | Ramanathapuram | 0 | 5,186 | 5,186 | 0 | 0 | | | -- | | 0 | -- |
| | Virudunagar | 0 | 3,902 | 3,902 | 0 | 0 | | | -- | | 0 | -- |
| | Sivagangai | 0 | 3,169 | 3,169 | 0 | 0 | | | -- | | 0 | -- |
| | Sub-total | 0 | 12,706 | 12,706 | 0 | 0 | | | -- | | 0 | -- |
| | STATE | 0 | 21,471 | 21,471 | 0 | 0 | | | -- | | 0 | -- |
| Onion | Tiruvallur & Kanchipuram | 22 | 9 | 31 | 71 | | | 260 | | | 8,387 | |
| | Ramanathapuram | 3 | 0 | 3 | 100 | 20 | 0 | 20 | 6,667 | -- | 6,667 | -- |
| | Virudunagar | 941 | 6 | 947 | 99 | | | 6,300 | | | 6,653 | |
| | Sivagangai | 1 | 0 | 1 | 100 | 10 | 0 | 10 | 10,000 | -- | 10,000 | -- |
| | Sub-total | 967 | 15 | 982 | 98 | | | 6,590 | | | 6,711 | |
| | STATE | 21,779 | 499 | 22,278 | 98 | | | 185,400 | | | 8,322 | |
| Fruits & Other Vegetables | Tiruvallur & Kanchipuram | 4,860 | 6,542 | 11,402 | 43 | | | 114,030 | | | 10,001 | |
| | Ramanathapuram | 165 | 198 | 363 | 45 | | | 1,930 | | | 5,317 | |
| | Virudunagar | 2,668 | 516 | 3,184 | 84 | | | 26,620 | | | 8,361 | |
| | Sivagangai | 713 | 4,745 | 5,458 | 13 | | | 16,120 | | | 2,953 | |
| | Sub-total | 8,406 | 12,001 | 20,407 | 41 | | | 158,700 | | | 7,777 | |
| | STATE | 167,117 | 199,365 | 366,482 | 46 | | | 2,805,610 | | | 7,656 | |
| Gingelly | Tiruvallur & Kanchipuram | 3,073 | 1,053 | 4,126 | 74 | 2,070 | 380 | 2,450 | 674 | 361 | 594 | 187 |
| | Ramanathapuram | 331 | 3,429 | 3,760 | 9 | 250 | 800 | 1,050 | 755 | 233 | 279 | 324 |
| | Virudunagar | 242 | 7,019 | 7,261 | 3 | 190 | 2,000 | 2,190 | 785 | 285 | 302 | 276 |
| | Sivagangai | 75 | 723 | 798 | 9 | 60 | 260 | 320 | 800 | 360 | 401 | 222 |
| | Sub-total | 3,721 | 12,224 | 15,945 | 23 | 2,570 | 3,440 | 6,010 | 691 | 281 | 377 | 245 |
| | STATE | 44,288 | 96,510 | 140,798 | 31 | 33,850 | 34,970 | 68,820 | 764 | 362 | 489 | 211 |
| Groundnut | Tiruvallur & Kanchipuram | 57,410 | 28,797 | 86,207 | 67 | 128,430 | 25,530 | 153,960 | 2,237 | 887 | 1,786 | 252 |
| | Ramanathapuram | 299 | 10,112 | 10,411 | 3 | 670 | 12,250 | 12,920 | 2,241 | 1,211 | 1,241 | 185 |
| | Virudunagar | 2,086 | 9,814 | 11,900 | 18 | 4,670 | 7,280 | 11,950 | 2,239 | 742 | 1,004 | 302 |
| | Sivagangai | 1,310 | 12,245 | 13,555 | 10 | 2,930 | 9,770 | 12,700 | 2,237 | 798 | 937 | 280 |
| | Sub-total | 61,105 | 60,968 | 122,073 | 50 | 136,700 | 54,830 | 191,530 | 2,237 | 899 | 1,569 | 249 |
| | STATE | 379,027 | 809,378 | 1,188,405 | 32 | 847,940 | 918,380 | 1,766,320 | 2,237 | 1,135 | 1,486 | 197 |
| Castor | Tiruvallur & Kanchipuram | 0 | 0 | 0 | -- | 0 | 0 | 0 | -- | -- | -- | -- |
| | Ramanathapuram | 2 | 0 | 2 | 100 | | 0 | | | -- | 0 | |
| | Virudunagar | 6 | 24 | 30 | 20 | | | 50 | | | 1,667 | |
| | Sivagangai | 1 | 2 | 3 | 33 | | | | | | | |
| | Sub-total | 9 | 26 | 35 | 26 | | | | | | | |
| | STATE | 1,067 | 26,284 | 27,351 | 4 | | | 200 | | | 7 | |

Source : Season and Crop Report of Tamil Nadu. Government Central Press, Madras

## Table 3.3.2 Crop Production under Irrigation/Non-irrigation in the Study Area and the State in 1992 - 93 ( 3/3 )

| Crop | Study area and State (District) | Area (ha) | | | | Production(ton) | | | Yield(kg/ha) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Irrigated (A) | Non-Irrigated | Total (B) | A/B (%) | Irrigated | Non-Irrigated | Total | Irrigated (A) | Non-Irrigated(B) | Total | A/B (%) |
| Coconut | Tiruvallur & Kanchipuram | 2,191 | 1,376 | 3,567 | 61 | | | | | | 0 | |
| | Ramanathapuram | 4,646 | 2,306 | 6,952 | 67 | | | | | | 0 | |
| | Virudunagar | 5,238 | 0 | 5,238 | 100 | | 0 | | | -- | 0 | -- |
| | Sivagangai | 1,774 | 2,081 | 3,855 | 46 | | | | | | 0 | |
| | Sub-total | 13,849 | 5,763 | 19,612 | 71 | | | | | | 0 | |
| | STATE | 133,040 | 63,345 | 196,385 | 68 | | | | | | 0 | |
| Sunflower | Tiruvallur & Kanchipuram | 47 | 0 | 47 | 100 | 30 | 0 | 30 | 638 | -- | 638 | -- |
| | Ramanathapuram | 0 | 536 | 536 | 0 | 0 | 380 | 380 | -- | 709 | 709 | -- |
| | Virudunagar | 6 | 2,804 | 2,810 | 0 | | | 1,090 | | | 388 | |
| | Sivagangai | 9 | 14 | 23 | 39 | | | 20 | | | 870 | |
| | Sub-total | 62 | 3,354 | 3,416 | 2 | | | 1,520 | | | 445 | |
| | STATE | 6,660 | 25,072 | 31,732 | 21 | | | 22,280 | | | 702 | |
| Other Oilseeds | Tiruvallur & Kanchipuram | 910 | 2 | 912 | 100 | | | | | | | |
| | Ramanathapuram | 5 | 0 | 5 | 100 | | 0 | | | -- | | -- |
| | Virudunagar | 5 | 102 | 107 | 5 | | | | | | | |
| | Sivagangai | 0 | 1 | 1 | 0 | 0 | | | -- | | | -- |
| | Sub-total | 920 | 105 | 1,025 | 90 | | | | | | | |
| | STATE | 9,609 | 5,734 | 15,343 | 63 | | | | | | | |
| Cotton (Bales of 170kg/ lint) | Tiruvallur & Kanchipuram | 108 | 56 | 164 | 66 | 290 | 70 | 360 | 2,685 | 1,250 | 2,195 | 215 |
| | Ramanathapuram | 510 | 3,799 | 4,309 | 12 | 1,380 | 4,520 | 5,900 | 2,706 | 1,190 | 1,369 | 227 |
| | Virudunagar | 8,224 | 40,882 | 49,106 | 17 | 13,740 | 36,050 | 49,790 | 1,671 | 882 | 1,014 | 189 |
| | Sivagangai | 809 | 332 | 1,141 | 71 | 2,200 | 390 | 2,590 | 2,719 | 1,175 | 2,270 | 231 |
| | Sub-total | 9,651 | 45,069 | 54,720 | 18 | 17,610 | 41,030 | 58,640 | 1,825 | 910 | 1,072 | 200 |
| | STATE | 89,329 | 177,644 | 266,973 | 33 | 242,480 | 211,510 | 453,990 | 2,714 | 1,191 | 1,701 | 228 |
| Other Fibres | Tiruvallur & Kanchipuram | 0 | 0 | 0 | -- | 0 | 0 | 0 | -- | -- | -- | -- |
| | Ramanathapuram | 0 | 0 | 0 | -- | 0 | 0 | 0 | -- | -- | -- | -- |
| | Virudunagar | 0 | 0 | 0 | -- | 0 | 0 | 0 | -- | -- | -- | -- |
| | Sivagangai | 0 | 0 | 0 | -- | 0 | 0 | 0 | -- | -- | -- | -- |
| | Sub-total | 0 | 0 | 0 | -- | 0 | 0 | 0 | -- | -- | -- | -- |
| | STATE | 0 | 79 | 79 | 0 | 0 | | | -- | -- | -- | -- |
| Tobacco | Tiruvallur & Kanchipuram | 0 | 0 | 0 | -- | 0 | 0 | 0 | -- | -- | -- | -- |
| | Ramanathapuram | 0 | 0 | 0 | -- | 0 | 0 | 0 | -- | -- | -- | -- |
| | Virudunagar | 1 | 0 | 1 | 100 | | 0 | | | -- | | |
| | Sivagangai | 0 | 0 | 0 | -- | 0 | 0 | 0 | -- | -- | -- | -- |
| | Sub-total | 1 | 0 | 1 | 100 | | 0 | | | | 0 | |
| | STATE | 8,387 | 16 | 8,403 | 100 | | | 12,160 | | | 1,447 | |
| Other Drugs & Narcotics | Tiruvallur & Kanchipuram | 0 | 5 | 5 | 0 | 0 | | | -- | | | -- |
| | Ramanathapuram | 0 | 33 | 33 | 0 | 0 | | | -- | | | -- |
| | Virudunagar | 0 | 1,629 | 1,629 | 0 | 0 | | | -- | | | -- |
| | Sivagangai | 0 | 126 | 126 | 0 | 0 | | | -- | | | -- |
| | Sub-total | 0 | 1,793 | 1,793 | 0 | 0 | | | -- | | | -- |
| | STATE | 0 | 106,455 | 106,455 | 0 | 0 | | | -- | | | -- |
| Fodder | Tiruvallur & Kanchipuram | 9 | 31 | 40 | 23 | | | | | | | |
| | Ramanathapuram | 0 | 676 | 676 | 0 | 0 | | | | | | -- |
| | Virudunagar | 170 | 17,715 | 17,885 | 1 | | | | | | | |
| | Sivagangai | 185 | 462 | 647 | 29 | | | | | | | |
| | Sub-total | 364 | 18,884 | 19,248 | 2 | | | | | | | |
| | STATE | 10,452 | 190,610 | 201,062 | 5 | | | | | | | |
| Green Manure Crops | Tiruvallur & Kanchipuram | 0 | 103 | 103 | 0 | 0 | | | -- | -- | -- | -- |
| | Ramanathapuram | 0 | 0 | 0 | -- | 0 | 0 | 0 | -- | -- | -- | -- |
| | Virudunagar | 0 | 0 | 0 | -- | 0 | 0 | 0 | -- | -- | -- | -- |
| | Sivagangai | 0 | 0 | 0 | -- | 0 | 0 | 0 | -- | -- | -- | -- |
| | Sub-total | 0 | 103 | 103 | 0 | 0 | | | -- | | | |
| | STATE | 0 | 2,899 | 2,899 | 0 | 0 | | | -- | | | |
| Other Non-Food Crops | Tiruvallur & Kanchipuram | 1,070 | 24,464 | 25,534 | 4 | | | | | | | |
| | Ramanathapuram | 119 | 2,174 | 2,293 | 5 | | | | | | | |
| | Virudunagar | 689 | 1,609 | 2,298 | 30 | | | | | | | |
| | Sivagangai | 156 | 295 | 451 | 35 | | | | | | | |
| | Sub-total | 2,034 | 28,542 | 30,576 | 7 | | | | | | | |
| | STATE | 37,635 | 92,391 | 130,026 | 29 | | | | | | | |
| Total | Tiruvallur & Kanchipuram | 313,036 | 93,024 | 406,060 | 77 | | | | | | | |
| | Ramanathapuram | 68,222 | 148,186 | 216,408 | 32 | | | | | | | |
| | Virudunagar | 66,952 | 135,175 | 202,127 | 33 | | | | | | | |
| | Sivagangai | 91,545 | 49,627 | 141,172 | 65 | | | | | | | |
| | Sub-total | 539,755 | 426,012 | 965,767 | 56 | | | | | | | |
| | STATE | 3,384,718 | 3,679,759 | 7,064,477 | 48 | | | | | | | |

Source : Season and Crop Report of Tamil Nadu. Government Central Press, Madras

## Table 3.3.3 Production of Principal Crops in the Study Area (Avearage of 5 Years ending 1992 - 93) (1/2)

| District | Crop | Area Planted (ha) | % to total | Yield (kg/ha) | Production (ton) | Unit Price* (Rs/kg) | Gross Income (1,000 Rs) | % to total | (Rs/ha) |
|---|---|---|---|---|---|---|---|---|---|
| Tiruvallur and Kanchipuram District | Paddy(in rice) | 231,243 | 62.4 | 3,173 | 733,770 | 5.92 | 4,344,872 | 68.4 | 18,789 |
| | Maize | -- | -- | -- | -- | -- | -- | -- | -- |
| | Cholam | 412 | 0.1 | 1,238 | 510 | 3.60 | 1,835 | 0.0 | 4,454 |
| | Cumbu | 2,121 | 0.6 | 1,944 | 4,124 | 3.36 | 13,846 | 0.2 | 6,528 |
| | Ragi | 5,923 | 1.6 | 1,674 | 9,914 | 3.68 | 36,463 | 0.6 | 6,156 |
| | Korra | 5 | 0.0 | 800 | 4 | -- | -- | -- | -- |
| | Varagu | 156 | 0.0 | 1,064 | 166 | -- | -- | -- | -- |
| | Samai | 2 | 0.0 | -- | -- | -- | -- | -- | -- |
| | Other Cereals | 3 | 0.0 | 667 | 2 | -- | -- | -- | -- |
| | Bengal gram | 138 | 0.0 | 667 | 92 | 10.71 | 986 | 0.0 | 7,142 |
| | Red gram | 1,078 | 0.3 | 588 | 634 | 10.35 | 6,561 | 0.1 | 6,086 |
| | Green gram | 3,465 | 0.9 | 403 | 1,398 | 11.22 | 15,683 | 0.2 | 4,526 |
| | Black gram | 4,445 | 1.2 | 475 | 2,110 | 8.10 | 17,100 | 0.3 | 3,847 |
| | Horse gram | 607 | 0.2 | 409 | 248 | -- | -- | -- | -- |
| | Other Pulses | 1,165 | 0.3 | 254 | 296 | -- | -- | -- | -- |
| | Sugarcane(in gur) | 10,830 | 2.9 | 11,314 | 122,534 | 7.00** | 857,738 | 13.5 | 79,200 |
| | Chillies | 981 | 0.3 | 917 | 900 | 27.59 | 24,833 | 0.4 | 25,314 |
| | Turmeric | 4 | 0.0 | 5,500 | 22 | 26.37 | 580 | 0.0 | 145,052 |
| | Cardamom | -- | -- | -- | -- | -- | -- | -- | -- |
| | Coriander | 9 | 0.0 | 222 | 2 | 14.53 | 29 | 0.0 | 3,230 |
| | Tamarind | 113 | 0.0 | 3,628 | 410 | 13.18 | 5,405 | 0.1 | 47,831 |
| | Sweet Potato | 408 | 0.1 | 20,201 | 8,242 | -- | -- | -- | -- |
| | Onion | 26 | 0.0 | 8,923 | 232 | -- | -- | -- | -- |
| | Tapioca | 153 | 0.0 | 32,641 | 4,994 | -- | -- | -- | -- |
| | Mango | 4,821 | 1.3 | 6,689 | 32,250 | -- | -- | -- | -- |
| | Banana | 1,473 | 0.4 | 33,246 | 48,972 | -- | -- | -- | -- |
| | Citrus | 82 | 0.0 | -- | -- | -- | -- | -- | -- |
| | Cotton(in lint) | 205 | 0.1 | 342 | 70 | -- | -- | -- | -- |
| | Groundnut(in pods) | 71,551 | 19.3 | 1,577 | 112,836 | 8.96 | 1,010,819 | 15.9 | 14,127 |
| | Gingelly | 3,521 | 0.9 | 407 | 1,432 | 13.27 | 19,009 | 0.3 | 5,399 |
| | Castor | 7 | 0.0 | -- | -- | -- | -- | -- | -- |
| | Tobacco | -- | -- | -- | -- | -- | -- | -- | -- |
| | Others | 25,850 | 7.0 | -- | -- | -- | -- | -- | -- |
| | Total | 370,797 | 100.0 | | | | 6,355,759 | 100.0 | |
| Ramanathapuram District | Paddy(in rice) | 139,698 | 66.7 | 1,091 | 152,472 | 5.92 | 902,832 | 75.3 | 6,463 |
| | Cholam | 3,498 | 1.7 | 998 | 3,490 | 3.60 | 12,557 | 1.0 | 3,590 |
| | Cumbu | 3,286 | 1.6 | 571 | 1,876 | 3.36 | 6,299 | 0.5 | 1,917 |
| | Ragi | 6,043 | 2.9 | 920 | 5,562 | 3.68 | 20,456 | 1.7 | 3,385 |
| | Korra | 325 | 0.2 | 431 | 140 | -- | -- | -- | -- |
| | Varagu | 277 | 0.1 | 1,069 | 296 | -- | -- | -- | -- |
| | Samai | 48 | 0.0 | 667 | 32 | -- | -- | -- | -- |
| | Other Cereals | 2,282 | 1.1 | 565 | 1,290 | -- | -- | -- | -- |
| | Red gram | 275 | 0.1 | 589 | 162 | 10.35 | 1,676 | 0.1 | 6,096 |
| | Green gram | 919 | 0.4 | 407 | 374 | 11.22 | 4,196 | 0.3 | 4,565 |
| | Black gram | 3,452 | 1.6 | 450 | 1,554 | 8.10 | 12,594 | 1.0 | 3,648 |
| | Horse gram | 398 | 0.2 | 427 | 170 | -- | -- | -- | -- |
| | Other Pulses | 863 | 0.4 | 190 | 164 | -- | -- | -- | -- |
| | Sugarcane(in gur) | 99 | 0.0 | 11,010 | 1,090 | 7.00** | 7,630 | 0.6 | 77,071 |
| | Chillies | 11,199 | 5.3 | 391 | 4,376 | 27.59 | 120,744 | 10.1 | 10,782 |
| | Turmeric | 2 | 0.0 | 4,000 | 8 | 26.37 | 211 | 0.0 | 105,492 |
| | Coriander | 2,486 | 1.2 | 331 | 824 | 14.53 | 11,976 | 1.0 | 4,817 |
| | Tamarind | 240 | 0.1 | 3,000 | 720 | 13.18 | 9,492 | 0.8 | 39,548 |
| | Sweet Potato | 2 | 0.0 | 24,000 | 48 | -- | -- | -- | -- |
| | Onion | 7 | 0.0 | 9,714 | 68 | -- | -- | -- | -- |
| | Tapioca | 1 | 0.0 | 26,000 | 26 | -- | -- | -- | -- |
| | Mango | 100 | 0.0 | 6,100 | 610 | -- | -- | -- | -- |
| | Banana | 116 | 0.1 | 30,845 | 3,578 | -- | -- | -- | -- |
| | Citrus | 8 | 0.0 | 2,000 | 16 | -- | -- | -- | -- |
| | Cotton(in lint) | 4,366 | 2.1 | 209 | 912 | -- | -- | -- | -- |
| | Groundnut(in pods) | 10,233 | 4.9 | 883 | 9,036 | 8.96 | 80,947 | 6.7 | 7,910 |
| | Gingelly | 2,829 | 1.4 | 216 | 610 | 13.27 | 8,097 | 0.7 | 2,862 |
| | Others | 16,294 | 7.8 | -- | -- | -- | -- | -- | -- |
| | Total | 209,354 | 100.0 | | | | 1,199,708 | 100.0 | |

* : Unit Price: Annual average wholesale prices in 1992 - 93 in Tamil Nadu.

**: Average of 1st sort and 2nd sort.

Source: Season and Crop Report of Tamil Nadu, Government Central Press, Madras-600079.

## Table 3.3.3 Production of Principal Crops in the Study Area (Avearage of 5 Years ending 1992 - 93) (2/2)

| District | Crop | Area Planted (ha) | % to total | Yield (kg/ha) | Production (ton) | Unit Price* (Rs/kg) | Gross Income (1,000 Rs) | % to total | (Rs/ha) |
|---|---|---|---|---|---|---|---|---|---|
| Virudunagar District | Paddy(in rice) | 31,628 | 15.9 | 2,923 | 92,442 | 5.92 | 547,377 | 42.8 | 17,307 |
| | Maize | 652 | 0.3 | 2,012 | 1,312 | -- | -- | -- | -- |
| | Cholam | 6,833 | 3.4 | 1,448 | 9,896 | 3.60 | 35,605 | 2.8 | 5,211 |
| | Cumbu | 11,992 | 6.0 | 1,240 | 14,874 | 3.36 | 49,939 | 3.9 | 4,164 |
| | Ragi | 3,026 | 1.5 | 2,325 | 7,034 | 3.68 | 25,870 | 2.0 | 8,549 |
| | Korra | 90 | 0.0 | 444 | 40 | -- | -- | -- | -- |
| | Varagu | 2,247 | 1.1 | 1,179 | 2,650 | -- | -- | -- | -- |
| | Samai | 164 | 0.1 | 841 | 138 | -- | -- | -- | -- |
| | Other Cereals | 2,416 | 1.2 | 523 | 1,264 | -- | -- | -- | -- |
| | Bengal gram | 133 | 0.1 | 481 | 64 | 10.71 | 686 | 0.1 | 5,155 |
| | Red gram | 2,117 | 1.1 | 590 | 1,248 | 10.35 | 12,915 | 1.0 | 6,100 |
| | Green gram | 6,618 | 3.3 | 531 | 3,512 | 11.22 | 39,399 | 3.1 | 5,953 |
| | Black gram | 9,412 | 4.7 | 491 | 4,622 | 8.10 | 37,458 | 2.9 | 3,980 |
| | Horse gram | 160 | 0.1 | 388 | 62 | -- | -- | -- | -- |
| | Other Pulses | 3,274 | 1.6 | 189 | 620 | -- | -- | -- | -- |
| | Sugarcane*** | 3,601 | 1.8 | 11,631 | 41,882 | 7.00** | 293,174 | 22.9 | 81,415 |
| | Chillies | 5,862 | 3.0 | 545 | 3,192 | 27.59 | 88,075 | 6.9 | 15,025 |
| | Turmeric | -- | -- | | 2 | 26.37 | 53 | 0.0 | -- |
| | Cardamom | 380 | 0.2 | 84 | 32 | -- | -- | -- | -- |
| | Coriander | 4,882 | 2.5 | 311 | 1,518 | 14.53 | 22,063 | 1.7 | 4,519 |
| | Tamarind | 415 | 0.2 | 3,012 | 1,250 | 13.18 | 16,479 | 1.3 | 39,707 |
| | Sweet Potato | 35 | 0.0 | 19,943 | 698 | -- | -- | -- | -- |
| | Onion | 1,259 | 0.6 | 7,176 | 9,034 | -- | -- | -- | -- |
| | Tapioca | 7 | 0.0 | 32,571 | 228 | -- | -- | -- | -- |
| | Mango | 833 | 0.4 | 6,197 | 5,162 | -- | -- | -- | -- |
| | Banana | 781 | 0.4 | 31,260 | 24,414 | -- | -- | -- | -- |
| | Citrus | 99 | 0.0 | 2,303 | 228 | -- | -- | -- | -- |
| | Cotton*** | 50,656 | 25.5 | 227 | 11,498 | -- | -- | -- | -- |
| | Groundnut | 11,712 | 5.9 | 866 | 10,146 | 8.96 | 90,891 | 7.1 | 7,760 |
| | Gingelly | 6,410 | 3.2 | 220 | 1,408 | 13.27 | 18,690 | 1.5 | 2,916 |
| | Castor | 78 | 0.0 | 179 | 14 | -- | -- | -- | -- |
| | Tobacco | 5 | 0.0 | 1,200 | 6 | -- | -- | -- | -- |
| | Others | 30,747 | 15.5 | -- | -- | -- | -- | -- | -- |
| | Total | 198,524 | 100.0 | | | | 1,278,673 | 100.0 | |
| Sivagangai District | Paddy(in rice) | 85,787 | 68.2 | 2,049 | 175,778 | 5.92 | 1,040,834 | 66.6 | 12,133 |
| | Cholam | 570 | 0.5 | 1,165 | 664 | 3.60 | 2,389 | 0.2 | 4,191 |
| | Cumbu | 168 | 0.1 | 1,143 | 192 | 3.36 | 645 | 0.0 | 3,837 |
| | Ragi | 1,760 | 1.4 | 1,314 | 2,312 | 3.68 | 8,503 | 0.5 | 4,831 |
| | Korra | 47 | 0.0 | 426 | 20 | -- | -- | -- | -- |
| | Varagu | 316 | 0.3 | 1,089 | 344 | -- | -- | -- | -- |
| | Samai | 14 | 0.0 | 857 | 12 | -- | -- | -- | -- |
| | Other Cereals | 190 | 0.2 | 568 | 108 | -- | -- | -- | -- |
| | Red gram | 626 | 0.5 | 591 | 370 | 10.35 | 3,829 | 0.2 | 6,116 |
| | Green gram | 211 | 0.2 | 445 | 94 | 11.22 | 1,055 | 0.1 | 4,998 |
| | Black gram | 778 | 0.6 | 470 | 366 | 8.10 | 2,966 | 0.2 | 3,813 |
| | Horse gram | 250 | 0.2 | 400 | 100 | -- | -- | -- | -- |
| | Other Pulses | 746 | 0.6 | 190 | 142 | -- | -- | -- | -- |
| | Sugarcane(in gur) | 4,739 | 3.8 | 10,717 | 50,786 | 7.00** | 355,502 | 22.7 | 75,016 |
| | Chillies | 3,310 | 2.6 | 572 | 1,894 | 27.59 | 52,260 | 3.3 | 15,789 |
| | Turmeric | 1 | 0.0 | 2,000 | 2 | 26.37 | 53 | 0.0 | 52,746 |
| | Coriander | 77 | 0.1 | 312 | 24 | 14.53 | 349 | 0.0 | 4,530 |
| | Tamarind | 216 | 0.2 | 3,000 | 648 | 13.18 | 8,542 | 0.5 | 39,548 |
| | Sweet Potato | 2 | 0.0 | 21,000 | 42 | -- | -- | -- | -- |
| | Onion | 18 | 0.0 | 9,667 | 174 | -- | -- | -- | -- |
| | Tapioca | 14 | 0.0 | 33,000 | 462 | -- | -- | -- | -- |
| | Mango | 375 | 0.3 | 6,203 | 2,326 | -- | -- | -- | -- |
| | Banana | 461 | 0.4 | 31,262 | 14,412 | -- | -- | -- | -- |
| | Citrus | 3 | 0.0 | 2,000 | 6 | -- | -- | -- | -- |
| | Cotton(in lint) | 708 | 0.6 | 351 | 248 | -- | -- | -- | -- |
| | Groundnut(in pods) | 13,592 | 10.8 | 692 | 9,406 | 8.96 | 84,262 | 5.4 | 6,199 |
| | Gingelly | 563 | 0.4 | 316 | 178 | 13.27 | 2,363 | 0.2 | 4,197 |
| | Castor | 1 | 0.0 | -- | -- | -- | -- | -- | -- |
| | Others | 10,275 | 8.2 | -- | -- | -- | -- | -- | -- |
| | Total | 125,818 | 100.0 | -- | -- | -- | 1,563,551 | 100.0 | -- |

* : Unit Price: Annual average wholesale prices in 1992 - 93 in Tamil Nadu.

**: Average of 1st sort and 2nd sort.

Source: Season and Crop Report of Tamil Nadu, Government Central Press, Madras-600079.

## Table 3.3.4 Crop Budgets in Tank Irrigation System

**North Eastern Zone****

| | Mean Input Use and Main Product per Hectare | | | | | | | | Input Values, Total Cost and Gross Margin (Rs/ha) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Crops | SQ | HL | AL | N | P | K | OM | MPQ | SQ | HL | AL | MI, V | N | P | K | OM | PPV | TCOST | MPV |
| Paddy | 31.30 | 132.25 | 125.01 | 86.90 | 42.06 | 39.30 | 11.10 | 3,415.15 | 313.00 | 4,232.00 | 575.04 | 478.25 | 645.65 | 799.14 | 306.55 | 111.00 | 1,125.00 | 8,585.63 | 17,075.75 |
| Jowar | 18.78 | 63.05 | 35.26 | 3.45 | 0.00 | 0.00 | 4.00 | 755.45 | 281.70 | 2,017.60 | 162.20 | --- | 25.60 | --- | --- | 40.00 | 200.00 | 2,691.10 | 3,399.50 |
| Cumbu | 15.50 | 63.50 | 120.45 | 3.50 | 0.00 | 0.00 | 45.00 | 1,080.50 | 155.00 | 2,032.00 | 554.07 | --- | 26.00 | --- | --- | 45.00 | 175.00 | 3,012.07 | 4,320.00 |
| Ragi | 10.72 | 63.00 | 115.20 | 4.50 | 0.00 | 3.50 | 12.00 | 1,580.50 | 107.20 | 2,016.00 | 529.92 | --- | 21.80 | --- | 27.30 | 120.00 | 190.00 | 3,011.72 | 7,112.25 |
| Pulses | 22.00 | 70.50 | 109.67 | 0.15 | 0.00 | 0.00 | 4.00 | 821.20 | 440.00 | 2,256.00 | 504.48 | --- | 1.10 | --- | --- | 40.00 | 150.00 | 3,391.58 | 16,424.00 |
| Sugar cane | 9,433.35 | 225.40 | 45.40 | 153.34 | 55.10 | 71.20 | 41.00 | 94.50 | 1,415.00 | 7,212.80 | 207.00 | 168.12 | 1,139.30 | 1,046.90 | 555.36 | 410.00 | 1,050.00 | 13,204.36 | 37,800.00 |
| Groundnut | 120.43 | 106.95 | 104.40 | 7.50 | 15.55 | 14.23 | 25.50 | 996.51 | 3,010.75 | 3,422.40 | 480.24 | --- | 55.70 | 295.45 | 111.00 | 255.00 | 1,300.00 | 8,030.54 | 14,947.65 |
| Cotton | 8.25 | 144.30 | 125.50 | 36.54 | 15.34 | 13.56 | 29.20 | 1,044.50 | 206.25 | 4,617.60 | 577.30 | 68.12 | 271.50 | 291.46 | 105.75 | 292.00 | 2,000.00 | 8,429.86 | 16,182.00 |

**Southern Zone *****

| | Mean Input Use and Main Product per Hectare | | | | | | | | Input Values, Total Cost and Gross Margin (Rs/ha) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Crops | SQ | HL | AL | N | P | K | OM | MPQ | SQ | HL | AL | MI, V | N | P | K | OM | PPV | TCOST | MPV |
| Paddy | 26.90 | 128.40 | 100.89 | 76.15 | 26.16 | 30.45 | 21.10 | 2,989.66 | 269.00 | 4,108.80 | 464.09 | 150.00 | 565.79 | 497.04 | 237.01 | 211.00 | 1,000.00 | 7,503.23 | 14,948.30 |
| Jowar | 15.20 | 55.25 | 46.26 | 0.65 | 0.00 | 0.00 | 4.20 | 1,162.35 | 228.00 | 1,778.60 | 212.80 | --- | 4.83 | --- | --- | 42.00 | 150.00 | 2,405.63 | 5,230.58 |
| Cumbu | 13.60 | 50.25 | 78.35 | 0.00 | 0.00 | 0.00 | 2.50 | 1,012.55 | 136.00 | 1,608.00 | 360.41 | --- | --- | --- | --- | 25.00 | 125.00 | 2,254.41 | 4,048.00 |
| Ragi | 14.67 | 58.90 | 91.30 | 0.64 | 0.31 | 0.25 | 3.34 | 1,616.52 | 146.70 | 1,884.80 | 419.98 | --- | 4.75 | 5.89 | 1.95 | 33.00 | 150.00 | 2,647.07 | 7,274.34 |
| Pulses | 13.50 | 57.35 | 44.32 | 0.20 | 0.00 | 0.00 | 3.50 | 921.20 | 270.00 | 1,835.20 | 203.82 | --- | 1.50 | --- | --- | 35.00 | 50.00 | 2,395.67 | 12,896.80 |
| Sugar cane | 8,993.25 | 221.30 | 112.02 | 114.00 | 61.10 | 71.45 | 42.05 | 92.30 | 1,349.00 | 7,081.60 | 515.29 | 705.88 | 847.02 | 1,160.90 | 557.31 | 420.00 | 850.00 | 13,486.00 | 36,920.00 |
| Groundnut | 95.50 | 93.30 | 85.15 | 11.06 | 17.24 | 13.10 | 14.90 | 755.06 | 2,387.50 | 2,985.60 | 391.69 | --- | 128.09 | 327.56 | 102.18 | 149.00 | 900.00 | 7,371.62 | 11,325.90 |
| Cotton | 6.90 | 93.00 | 93.45 | 9.00 | 7.34 | 9.90 | 26.00 | 719.67 | 172.50 | 2,976.00 | 429.87 | 70.00 | 66.87 | 139.46 | 77.22 | 260.00 | 900.00 | 4,991.02 | 11,514.72 |

Notes : * SQ=Seed qty in kgs (Cane in serts), HL=Human labour in Man-days, AL=Animal labour, N=N fertilizer qty in kg, P=P fertilizer qty in kg, K=K fertilizer qty in qtl, MPQ=Main product yield in kg for Paddy, Jowar, Cunbu, Ragi and Pulses, S.cone., G nut Kernals in shell in kg, MLV=Machine labour value, PPV=Plant protection, MPV=Main product value, BPV=By product value, GR=Gross return, GM=Gross Margin

** North Eastern Zone - It comprises of Vellore, Thiruvannamalai, Cuddalore, Tiruvallur and Kanchipuram.

*** Southern Zone - It comprises of Tirunelveli, Tricorin, Virudunagar, Ramanathapuram, Sivaganga, Nagapattinam, Pudukottai and Dindigul districts.

Source : Water Technology Center, Tamil Nadu Agricultural University, Coimbatore

## Table 3.4.1 Requirment of Irrigation for Paddy

| Study Area | | Southern Study Area | | | | Northern Study Area | |
|---|---|---|---|---|---|---|---|
| Name of Station | | Kamtchipuram | Kavalur | Karaikudi | Pamban | Nungambakkam | Thiruttani |
| District | | Virudunagar | Virudunagar | Sivagangai | Ramanathapuram | Kanchipuram | Thiruttani |
| Rainfall (mm) | Annual | 782 | 779 | 797 | 791 | 1,397 | 971 |
| | NE Monsoon | 522 | 493 | 473 | 583 | 967 | 574 |
| | Annual.Effective | 643 | 645 | 671 | 611 | 925 | 763 |
| | NE Effective | 429 | 408 | 398 | 450 | 640 | 451 |
| Ratio | Annual | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| | NE Monsoon | 66.8% | 63.3% | 59.3% | 73.7% | 69.2% | 59.1% |
| | Annual Effective | 82.2% | 82.8% | 84.2% | 77.2% | 66.2% | 78.6% |
| | NE Effective | 54.9% | 52.4% | 50.0% | 56.9% | 45.8% | 46.5% |
| Crop Water Requirement Eto (mm)* | Annual | 1,914 | 1,718 | 1,730 | 1,870 | 1,706 | 1,749 |
| | NE Monsoon | 511 | 494 | 485 | 555 | 476 | 466 |
| Gross Water Requirement | Ei=0.6 | 852 | 823 | 808 | 925 | 793 | 777 |
| | Ei=0.75 | 681 | 659 | 647 | 740 | 635 | 621 |
| Irrigation Requirement | Ei=0.6 | 422 | 415 | 410 | 475 | 153 | 326 |
| | % for NE Effective | 98.4% | 101.7% | 103.0% | 105.4% | 23.9% | 72.2% |
| | Ei=0.75 | 209 | 178 | 137 | 314 | -132 | 14 |
| | % for NE Effective | 48.6% | 43.7% | 34.5% | 69.7% | -20.6% | 3.0% |
| Estimation 80% Reliable Rainfall** (mm) | Annual | 549 | 669 | 669 | 624 | 954 | 765 |
| | NE Monsoon | 366 | 423 | 397 | 460 | 660 | 452 |
| | Annual Effective | 451 | 554 | 563 | 482 | 632 | 601 |
| | NE Effective | 301 | 351 | 334 | 355 | 437 | 355 |
| Irrigation Requirement | Ei=0.6 | 550 | 473 | 474 | 570 | 356 | 421 |
| | % for NE Effective | 182.6% | 134.9% | 141.8% | 160.4% | 81.4% | 118.6% |
| | Ei=0.75 | 380 | 308 | 312 | 385 | 197 | 266 |
| | % for NE Eff. | 126.1% | 87.9% | 93.5% | 108.3% | 45.2% | 74.8% |
| Catchment Area Requirment | Ei=0.6, C=0.3 | 6.09 | 4.50 | 4.73 | 5.35 | 2.71 | 3.95 |
| | Ei=0.75, C=0.3 | 4.20 | 2.93 | 3.12 | 3.61 | 1.51 | 2.49 |

Notes : Ei= irrigation Efficiency, C= coefficient of runoff, ** refer page 3-15 of this report

* Source : Tank Irrigation System in Tamil Nadu (Phase II) Report No.2, Jun 1993

## Table 3.4.2 Summary of Baseline Survey in the Study Area

| Study Area | Northern | Southern | | | | Total |
|---|---|---|---|---|---|---|
| | Tiruvallur & Kanchipuram | Virudunagar | Sivagangai | Ramanathapuram | Total | |
| No. of PWD Tanks in Long List | 1,186 | 300 | 619 | 514 | 1,433 | 2,619 |
| No. of PWD Tanks in Baseline Survey | 985 | 257 | 561 | 265 | 1,083 | 2,068 |
| Sample Ratio | 83.05% | 85.67% | 90.63% | 51.56% | 75.58% | 78.96% |
| Surplus Water Year Occurance | 86.05% | 29.18% | 58.20% | 52.60% | 49.95% | 67.14% |
| Average Number of Holder per Tank | 197.3 | 161.3 | 131.51 | 138.54 | 144.43 | 169.61 |
| Average Number of Marginal Holder per Tank | 126.56 | 113.40 | 93.89 | 109.07 | 102.20 | 113.80 |
| Average Number of Small Holder per Tank | 43.29 | 30.87 | 28.79 | 21.66 | 27.52 | 35.03 |
| Total of Registered Area (ha) | 131,667 | 22,946 | 56,028 | 23,497 | 102,471 | 234,138 |
| Total of Average Cultivated Area (ha) | 102,108 | 15,737 | 31,260 | 18,678 | 65,675 | 167,783 |
| Average Share of Marginal Holders per Tank | 63.65% | 65.61% | 66.28% | 73.20% | 67.83% | 0.66 |
| Average Share of Marginal and Small Holders per Tank | 86.38% | 0.89% | 88.36% | 92.89% | 89.52% | 0.88 |
| Average Cultivated Area per Holder (ha) | 0.834 | 0.836 | 0.724 | 0.751 | 0.757 | 0.79 |
| Average Cultivated Area Share | 94.00% | 70.29% | 74.59% | 89.36% | 77.18% | 0.85 |

Source : Minor Irrigation Basline Survey, Department of Statistic

## Table 3.4.3 Constraints and Proposed Countermeasures for Rehabilitation of Minor Irrigation Tanks

| Component | | Category | Constraints | Countermeasures |
|---|---|---|---|---|
| Tank System Facilities | Tank | Catchment Area | • Soil erosion induced reduction in tank storage and tendency for silting up at intake points. | • Desilting of storage area and at intake points<br>• Conservation of catchment through soil erosion control measures such as afforestation and terracing |
| | | Tank Bund | • Insufficient top width and freeboard due to soil erosion of top level.<br>• leakage | • Restoration of top width and free board.<br>• Reinforcement of bund top and slopes with lining. |
| | Intake and outlet Structures | Intake Works | • Water leakage due to damaged shutters<br>• Broken water control facilities such as Plugs and Barrels<br>• Broken and damaged front and rear inlets and outlets | • Provision of new slide gates and shutters<br>• Provision of new plugs, plug rods and barrels<br>• Reconstruction of inlets and outlets. |
| | | Surplus Arrangement | • Insufficient length<br>• Damaged leaky body wall and eroded rear protective works. | • Increase of length and modifications of crest shape to increase discharges.<br>• Reconstruction and reinforcement of damaged works. |
| | Supply Works | Supply Channel | • Reduction of design discharge as a result of silting of channel.<br>• Deterioration of stone masonry channel.<br>• Insufficient flow velocity due to weed growth. | • Periodical desilting of supply channel.<br>• Reconstruction of damaged portion and strengthening at vulnerable sites.<br>• Cleaning of vegetation in the channel. |
| Irrigation System | Distribution Network | | • Slow movement due to obstruction by vegetation growth.<br>• Heavy seepage loss<br>• Salt injury in inundated command areas due to channel leakage. | • Periodical repair of channel by WUA.<br>• Lining of main distribution channel<br>• Proper maintenance of drainage channel |
| | Operation and Management | | • Occurrence of non irrigated area due to insufficient water control structures. | • Lined channel with proper regulating and diversion structures at off-take points. |
| | Irrigation management | | • Continuous over drawl without relevance to actual need, unofficial restoring subordinating equity to vested interests. | • Irrigation scheduling based on crop water requirements, cropping pattern and effective rainfall etc. |
| Farm Management | Agricultural Practices | | • Reduction in farm profit due to non proper cropping pattern, cropping schedule.<br>• Crop injury due to continuous cropping and insufficient use of treated seeds, fertilizers, pesticides. | • Proper selection of cropping pattern and crop calendar to match with land use pattern.<br>• Extension of new agricultural technology through Farmers' organization, , optimum use of fertilizers and proper plant protection measures and provision of agricultural credits |

## Table 3.4.4 Correlation of Tank Dimensions in the Study Area

### (1) Northern Study Area

| | Free Catchment Area | Equivalent Catchment Area (km) | Length of Bund (m) | Water Spread Area(km²) | Registered Ayacut (ha) | Average Cultivated Area (ha) | Tank Capacity (Mm³) | Average Water Depth (m/ha) | Total Farm Household | Weight of Marginal |
|---|---|---|---|---|---|---|---|---|---|---|
| Free Catchment Area | | 0.974 | 0.030 | | 0.107 | 0.148 | 0.482 | 0.212 | 0.085 | 0.025 |
| Equivalent Catchment Area (km) | | | 0.034 | | 0.081 | 0.160 | 0.469 | 0.264 | 0.039 | 0.032 |
| Length of Bund (m) | | | | | 0.289 | 0.368 | 0.221 | 0.185 | 0.072 | -0.031 |
| Water Spread Area(km²) | | | | | | | | | | |
| Ayacut (ha) | | | | | | 0.720 | 0.337 | 0.167 | 0.375 | -0.042 |
| Average Cultivated Area (ha) | | | | | | | 0.239 | -0.070 | 0.472 | -0.172 |
| Tank Capacity (Mm³) | | | | | | | | 0.855 | 0.120 | -0.158 |
| Average Water Depth (m/ha) | | | | | | | | | -0.043 | -0.144 |
| Total Farm Household | | | | | | | | | | -0.056 |
| Weight of Marginal | | | | | | | | | | |

Data source Baseline survey (1995) and Draft Inventory Survey(January 1997)

### (2) Southern Study Area

| | Free Catchment Area | Equivalent Catchment Area (km) | Length of Bund (m) | Water Spread Area(km²) | Registered Ayacut (ha) | Average Cultivated Area (ha) | Tank Capacity (Mm³) | Average Water Depth (m/ha) | Total Farm Household | Weight of Marginal |
|---|---|---|---|---|---|---|---|---|---|---|
| Free Catchment Area | | 0.422 | 0.409 | 0.294 | 0.293 | 0.313 | 0.616 | 0.406 | 0.115 | 0.049 |
| Equivalent Catchment Area (km) | | | 0.042 | 0.116 | 0.264 | 0.264 | 0.289 | -0.019 | 0.074 | -0.035 |
| Length of Bund (m) | | | | 0.188 | 0.075 | 0.079 | 0.424 | 0.382 | -0.025 | -0.018 |
| Water Spread Area(km²) | | | | | 0.067 | 0.011 | 0.246 | 0.112 | 0.010 | 0.035 |
| Ayacut (ha) | | | | | | 0.955 | 0.589 | -0.060 | 0.469 | -0.065 |
| Average Cultivated Area (ha) | | | | | | | 0.591 | -0.154 | 0.383 | -0.067 |
| Tank Capacity (Mm³) | | | | | | | | 0.031 | 0.112 | 0.058 |
| Average Water Depth (m/ha) | | | | | | | | | 0.041 | 0.017 |
| Total Farm Household | | | | | | | | | | 0.108 |
| Weight of Marginal | | | | | | | | | | |

Data source Baseline survey (1995) and Draft Inventory Survey(January 1997)

# Table 3.4.5 Distribution of Tank Command Area

**Northern Study Area**

| No | Name of Taluk | Number of Tank | Data Available Numbers | Weight of Taluk in Region | Command Area (ha) | | | | | | | Share in Taluk (%) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Total | Average | Maximum | Minimum | ss than 60 (ha) | 60 to 110 (ha) | more 110 (ha) | less 60 ha | 60 to 110 ha | more 100 ha |
| 1 | Ponneri | 55 | 50 | 4.6% | 7,277 | 145.54 | 450.83 | 41.68 | 7 | 17 | 26 | 14% | 34% | 52% |
| 2 | Gummidipoondi | 63 | 61 | 5.3% | 7,030 | 115.25 | 496.96 | 4.05 | 20 | 19 | 22 | 33% | 31% | 36% |
| 3 | Chengalpattu | 188 | 188 | 15.9% | 22,374 | 119.01 | 1,030.76 | 4.45 | 58 | 62 | 68 | 31% | 33% | 36% |
| 4 | Sriperumpudur | 111 | 108 | 9.4% | 13,838 | 128.13 | 841.36 | 4.31 | 28 | 40 | 40 | 26% | 37% | 37% |
| 5 | Uthiramerur | 83 | 80 | 7.0% | 7,939 | 99.24 | 350.06 | 8.17 | 27 | 29 | 24 | 34% | 36% | 30% |
| 6 | Kancheepuram | 96 | 88 | 8.1% | 13,246 | 150.52 | 2,370.70 | 20.23 | 29 | 23 | 36 | 33% | 26% | 41% |
| 7 | Saidapet | 89 | 81 | 7.5% | 8,972 | 110.77 | 1,145.29 | 40.47 | 28 | 34 | 19 | 35% | 42% | 23% |
| 8 | Thiruvallur | 135 | 131 | 11.4% | 15,384 | 117.44 | 978.55 | 7.28 | 43 | 41 | 47 | 33% | 31% | 36% |
| 9 | Uthukottai | 61 | 58 | 5.1% | 6,841 | 117.96 | 571.43 | 40.57 | 17 | 23 | 18 | 29% | 40% | 31% |
| 10 | Thirutheni | 64 | 62 | 5.4% | 6,901 | 111.31 | 847.97 | 40.50 | 24 | 23 | 15 | 39% | 37% | 24% |
| 11 | Pallipet | 33 | 33 | 2.8% | 3,091 | 93.67 | 276.96 | 40.47 | 13 | 12 | 8 | 39% | 36% | 24% |
| 12 | Maduranthakkam | 161 | 160 | 13.6% | 16,930 | 105.81 | 1,154.19 | 30.72 | 64 | 61 | 35 | 40% | 38% | 22% |
| 13 | Acharapakkam | 47 | 47 | 4.0% | 4,605 | 97.99 | 210.04 | 21.97 | 8 | 27 | 12 | 17% | 57% | 26% |
| | Whole District | 1,186 | 1,147 | 100.0% | 134,430 | 116.36 | 2,370.70 | 4.05 | 366 | 411 | 370 | 32% | 36% | 32% |

Source : Draft Tank Inventory List January 1997

**Southern Study Area**

| No | Name of District | N | Name of Taluk | Number of Tank | Data Available Number | Share of Tank in Region | Command Area (ha) | | | | No. of Command Area Range | | | Share in Taluk (%) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Total | Average | Maximum | Minimum | less than 55 (ha) | 55 to 90 (ha) | 90 more (ha) | less 55 (ha) | 55 to 90 (ha) | more 90 (ha) |
| 1 | Ramana-thapuram | 1 | Thiruvadanai | 177 | 174 | 12.4% | 17,670 | 101.6 | 485.0 | 37.3 | 59 | 48 | 67 | 33.9% | 27.6% | 38.5% |
| 2 | | 2 | Paramakkudi | 109 | 108 | 7.6% | 10,556 | 97.7 | 303.2 | 41.2 | 25 | 38 | 45 | 23.1% | 35.2% | 41.7% |
| 3 | | 3 | Kamuthi | 37 | 37 | 2.6% | 3,608 | 97.5 | 461.5 | 30.0 | 18 | 9 | 10 | 48.6% | 24.3% | 27.0% |
| 4 | | 4 | Muthukulathur | 84 | 83 | 5.9% | 7,945 | 95.7 | 529.8 | 30.6 | 32 | 25 | 26 | 38.6% | 30.1% | 31.3% |
| 5 | | 5 | Ramanantheapura | 107 | 107 | 7.5% | 15,007 | 140.3 | 1,603.5 | 32.5 | 26 | 24 | 57 | 24.3% | 22.4% | 53.3% |
| 6 | Sivagangai | 1 | Sivagangai | 180 | 162 | 12.6% | 10,306 | 63.6 | 221.1 | 36.9 | 86 | 55 | 21 | 53.1% | 34.0% | 13.0% |
| 7 | | 2 | Manamadurai | 153 | 149 | 10.7% | 21,876 | 146.8 | 1,571.4 | 40.5 | 44 | 39 | 66 | 29.5% | 26.2% | 44.3% |
| 8 | | 3 | Ilayangudi | 63 | 63 | 4.4% | 7,026 | 111.5 | 1,067.4 | 40.9 | 19 | 19 | 25 | 30.2% | 30.2% | 39.7% |
| 9 | | 4 | Devakottai | 55 | 53 | 3.8% | 4,275 | 80.7 | 451.3 | 41.6 | 19 | 21 | 13 | 35.8% | 39.6% | 24.5% |
| 10 | | 5 | Karaikudi | 89 | 89 | 6.2% | 5,448 | 61.2 | 147.2 | 40.6 | 48 | 31 | 10 | 53.9% | 34.8% | 11.2% |
| 11 | | 6 | Thirupattur | 79 | 77 | 5.5% | 6,588 | 85.6 | 414.5 | 40.6 | 34 | 22 | 21 | 44.2% | 28.6% | 27.3% |
| 12 | irudunaga | 1 | Virudhunagar | 18 | 17 | 1.3% | 1,231 | 72.4 | 137.5 | 41.2 | 7 | 7 | 3 | 41.2% | 41.2% | 17.6% |
| 13 | | 2 | Sattur | 30 | 27 | 2.1% | 2,254 | 83.5 | 204.9 | 40.5 | 10 | 10 | 7 | 37.0% | 37.0% | 25.9% |
| 14 | | 3 | Rajapalayam | 56 | 55 | 3.9% | 5,230 | 95.1 | 355.2 | 40.6 | 13 | 19 | 23 | 23.6% | 34.5% | 41.8% |
| 15 | | 4 | Arupukottai | 136 | 132 | 9.5% | 11,755 | 89.1 | 538.5 | 40.7 | 60 | 39 | 33 | 45.5% | 29.5% | 25.0% |
| 16 | | 5 | Srivilliputhur | 60 | 59 | 4.2% | 5,497 | 93.2 | 402.0 | 41.2 | 21 | 17 | 21 | 35.6% | 28.8% | 35.6% |
| | Total | | | 1,433 | 1,392 | 100.0% | 136,271 | 97.9 | 1,603.5 | 30.0 | 521 | 423 | 448 | 37.4% | 30.4% | 32.2% |

Source : Draft Tank Inventory List January 1997

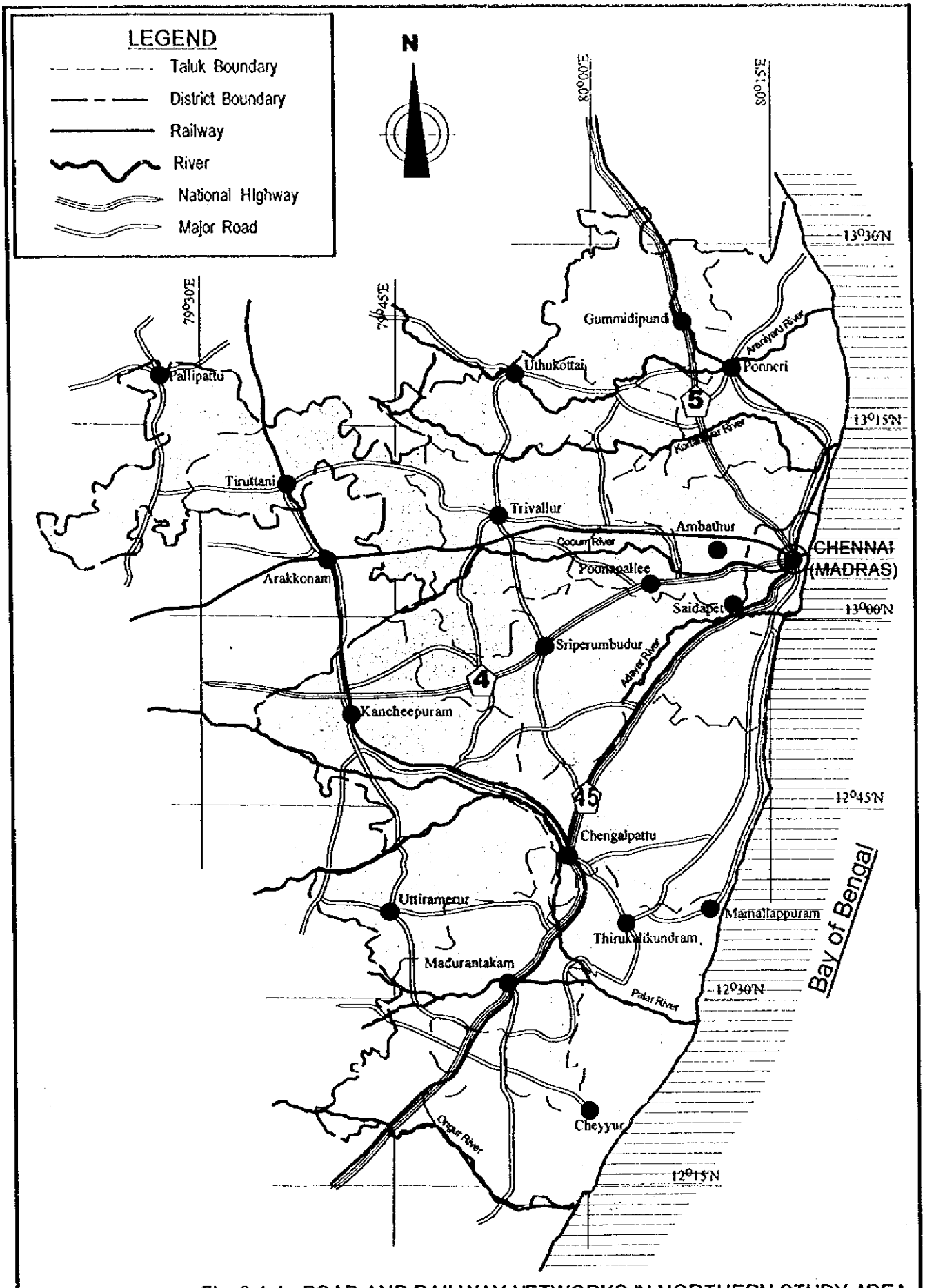



Fig. 3.1.1 ROAD AND RAILWAY NETWORKS IN NORTHERN STUDY AREA

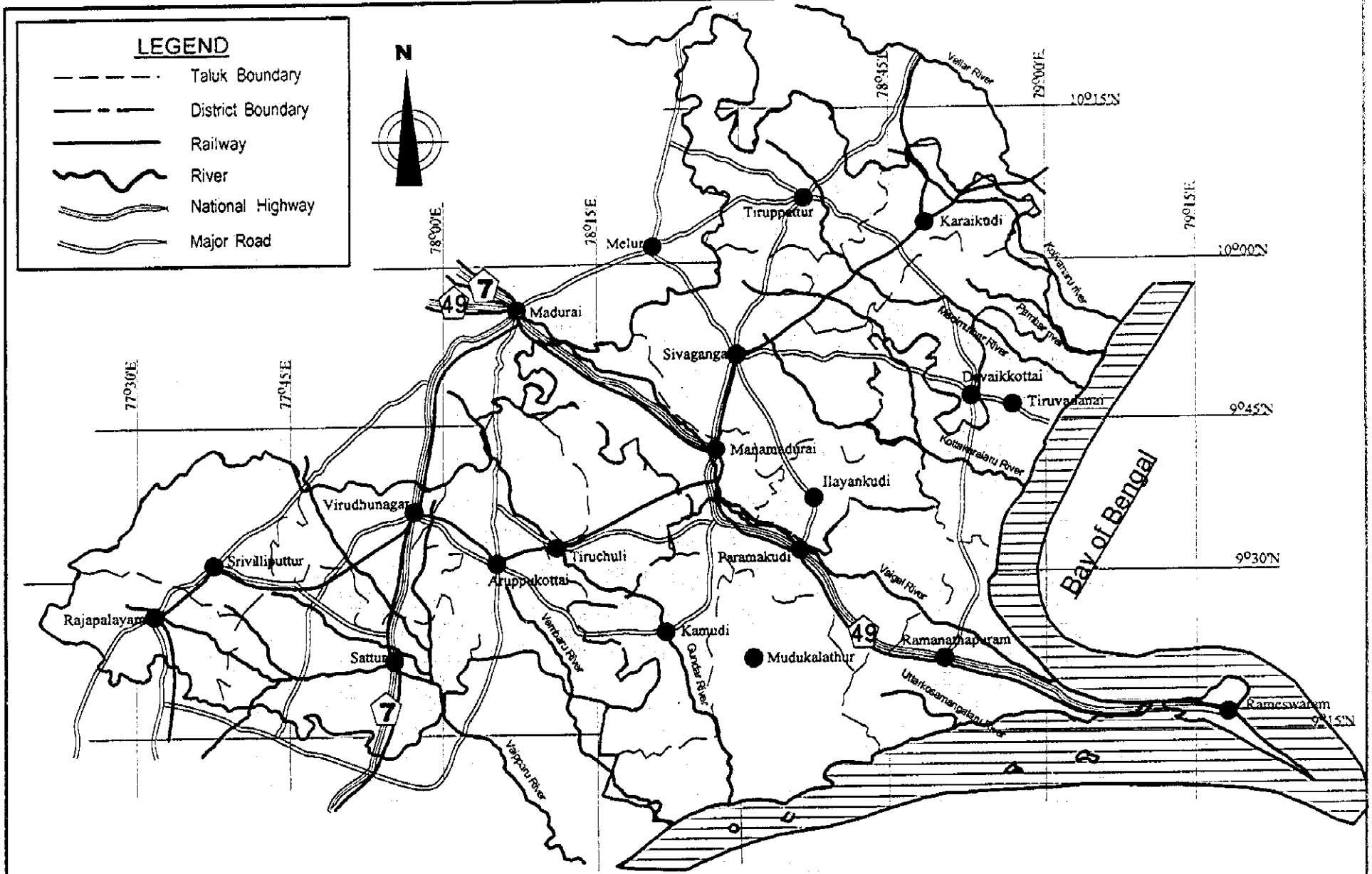



Fig. 3.1.2 ROAD AND RAILWAY NETWORKS IN SOUTHERN STUDY AREA

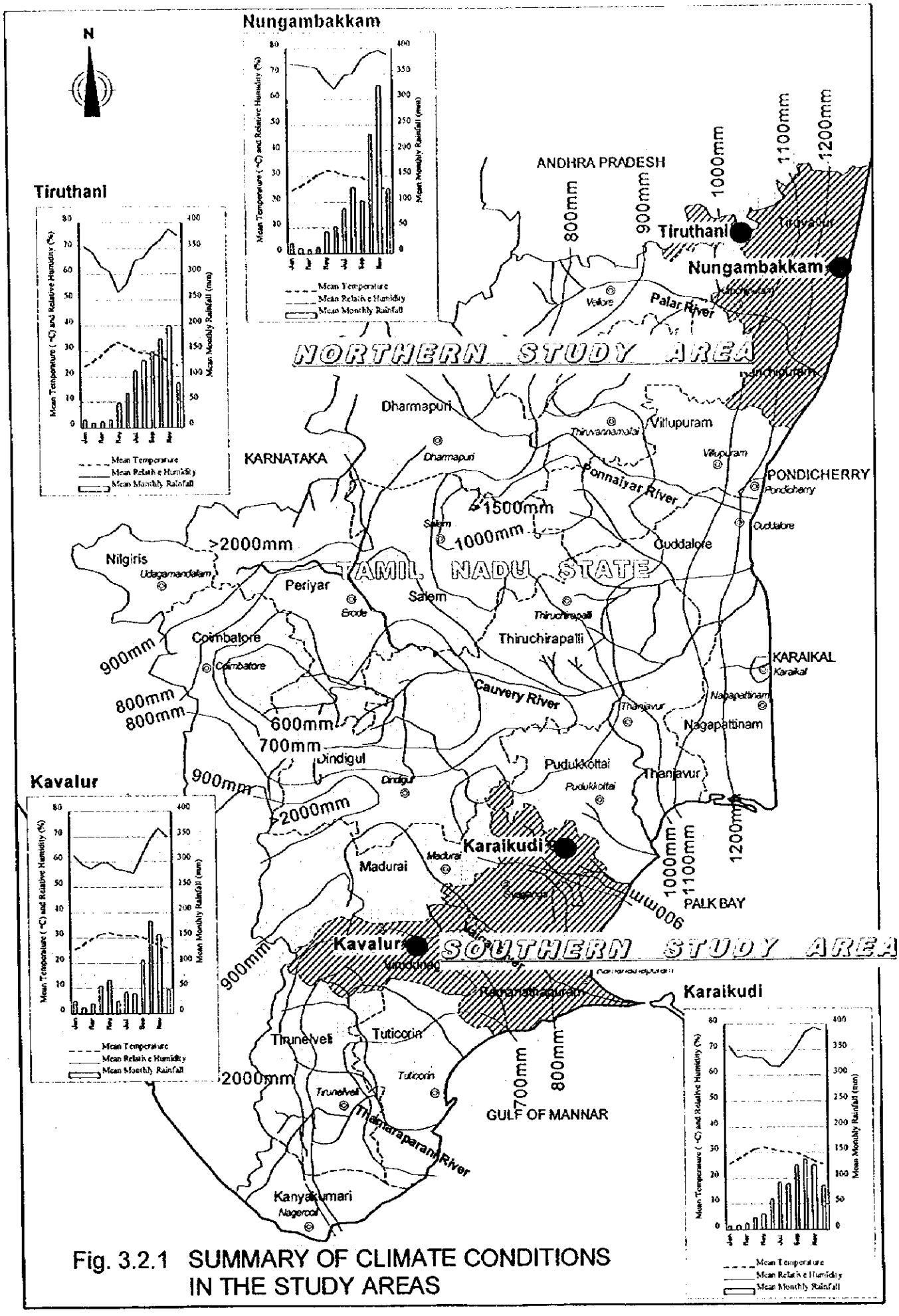



Fig. 3.2.1 SUMMARY OF CLIMATE CONDITIONS IN THE STUDY AREAS

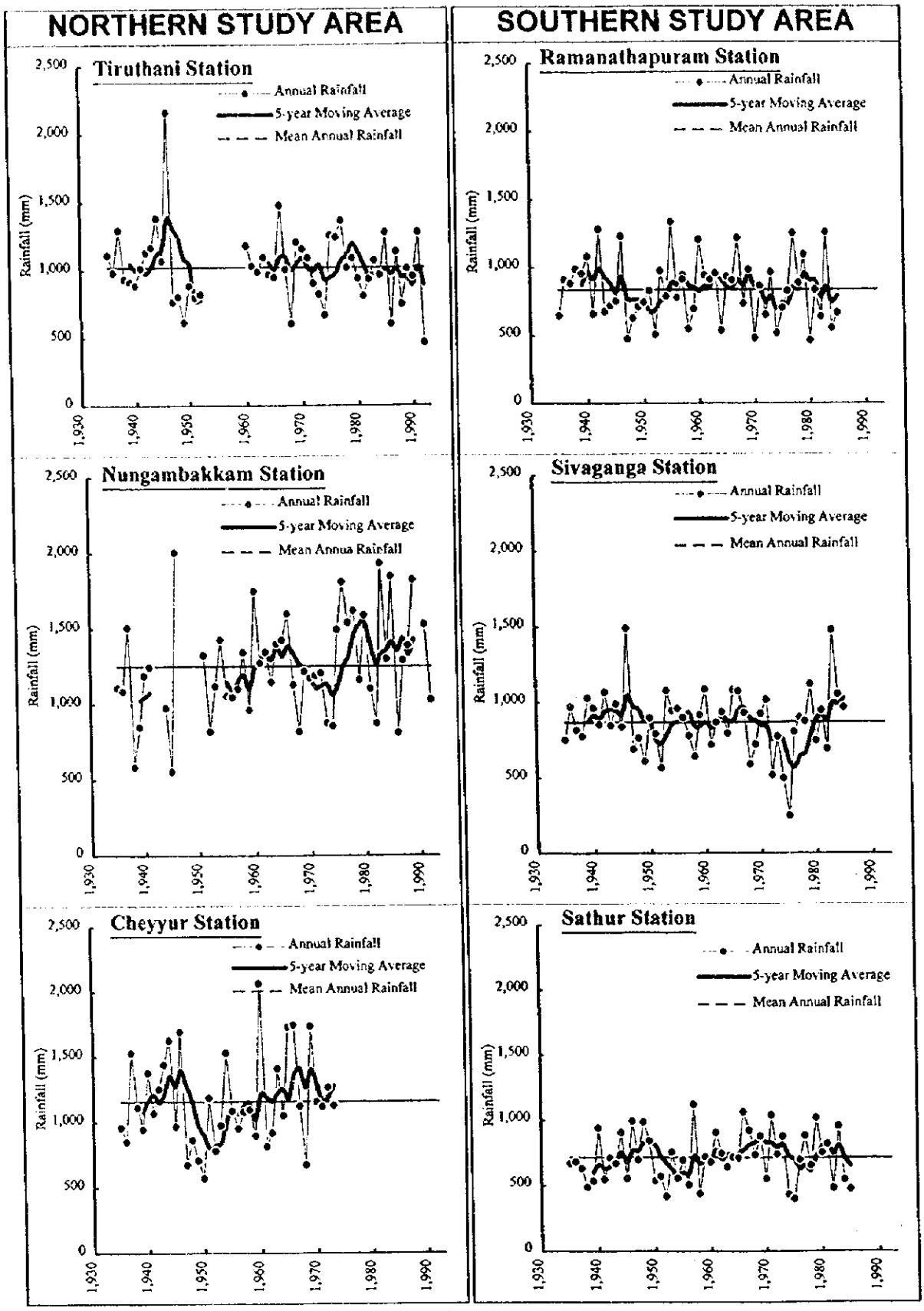



**Fig. 3.2.2 TREND IN ANNUAL RAINFALLS IN THE STUDY AREAS**

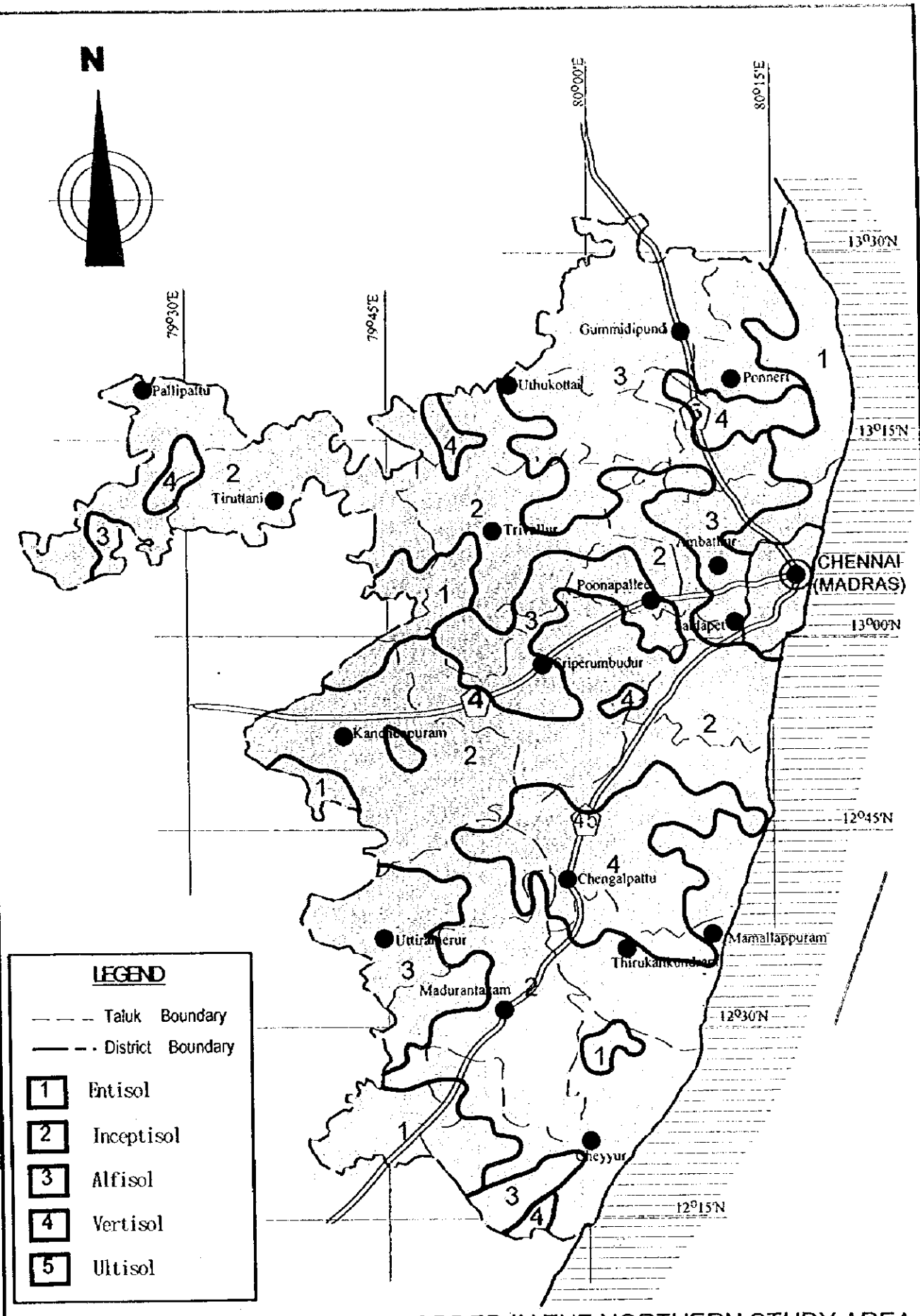



Fig. 3.2.3 SOIL ORDER IN THE NORTHERN STUDY AREA

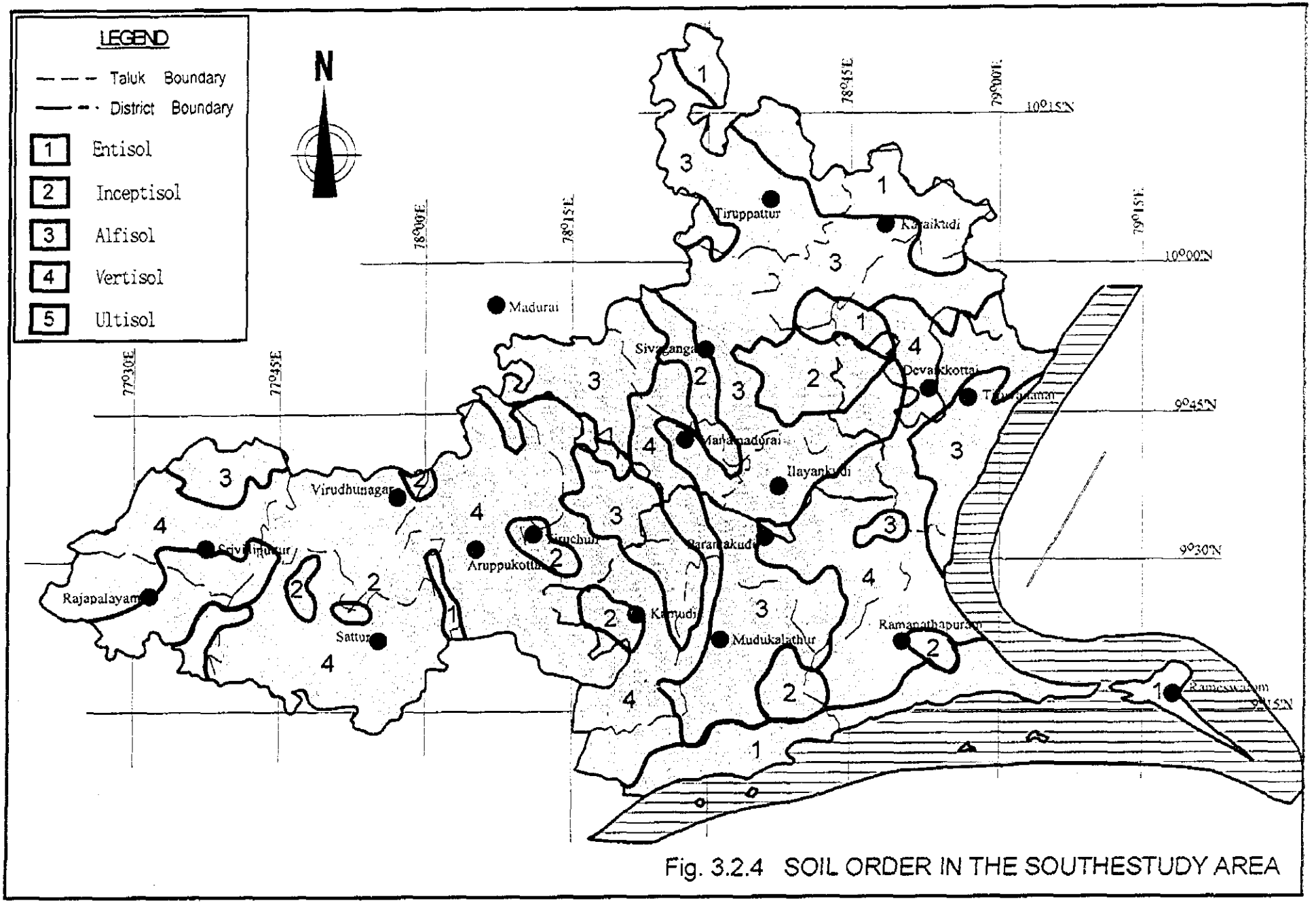
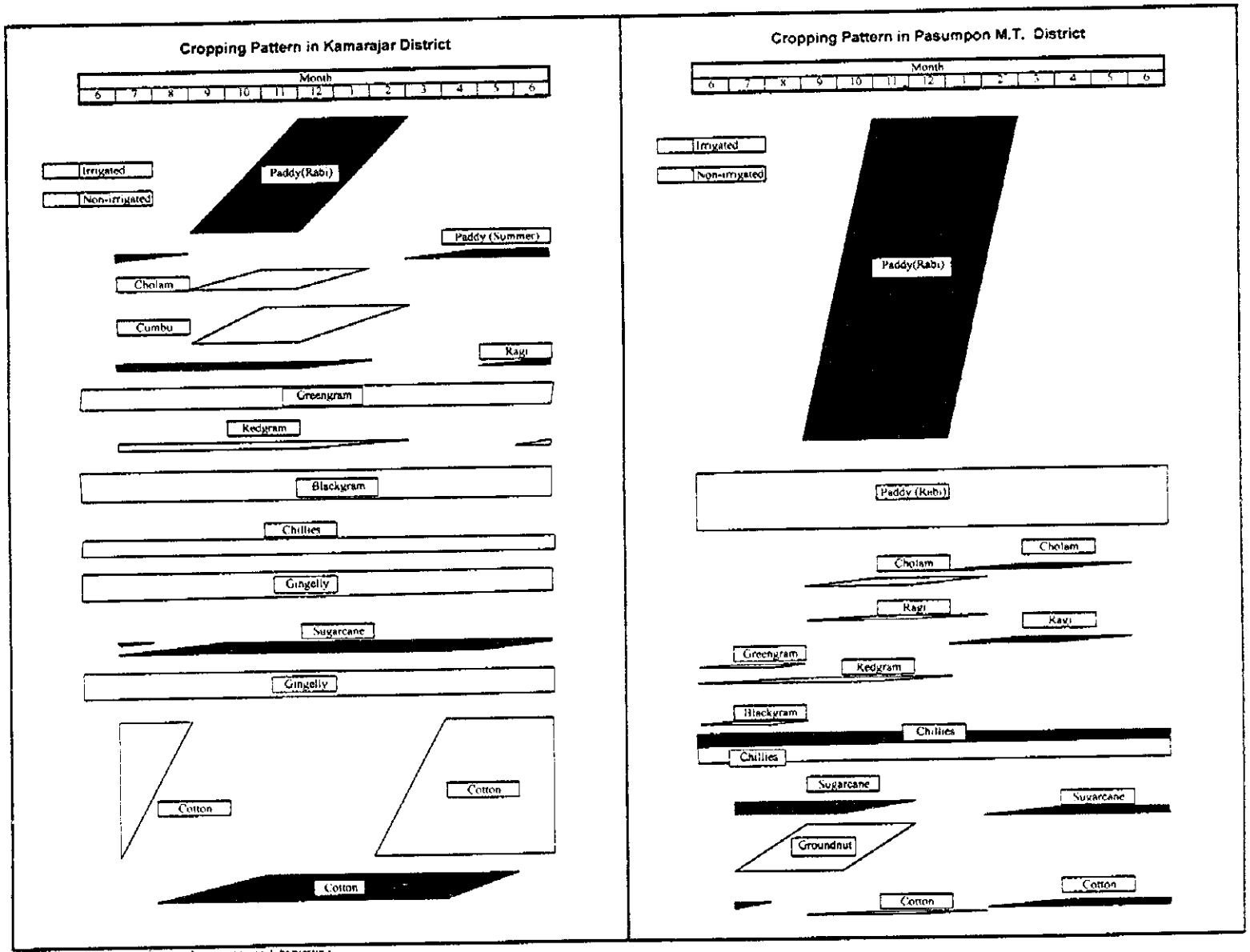
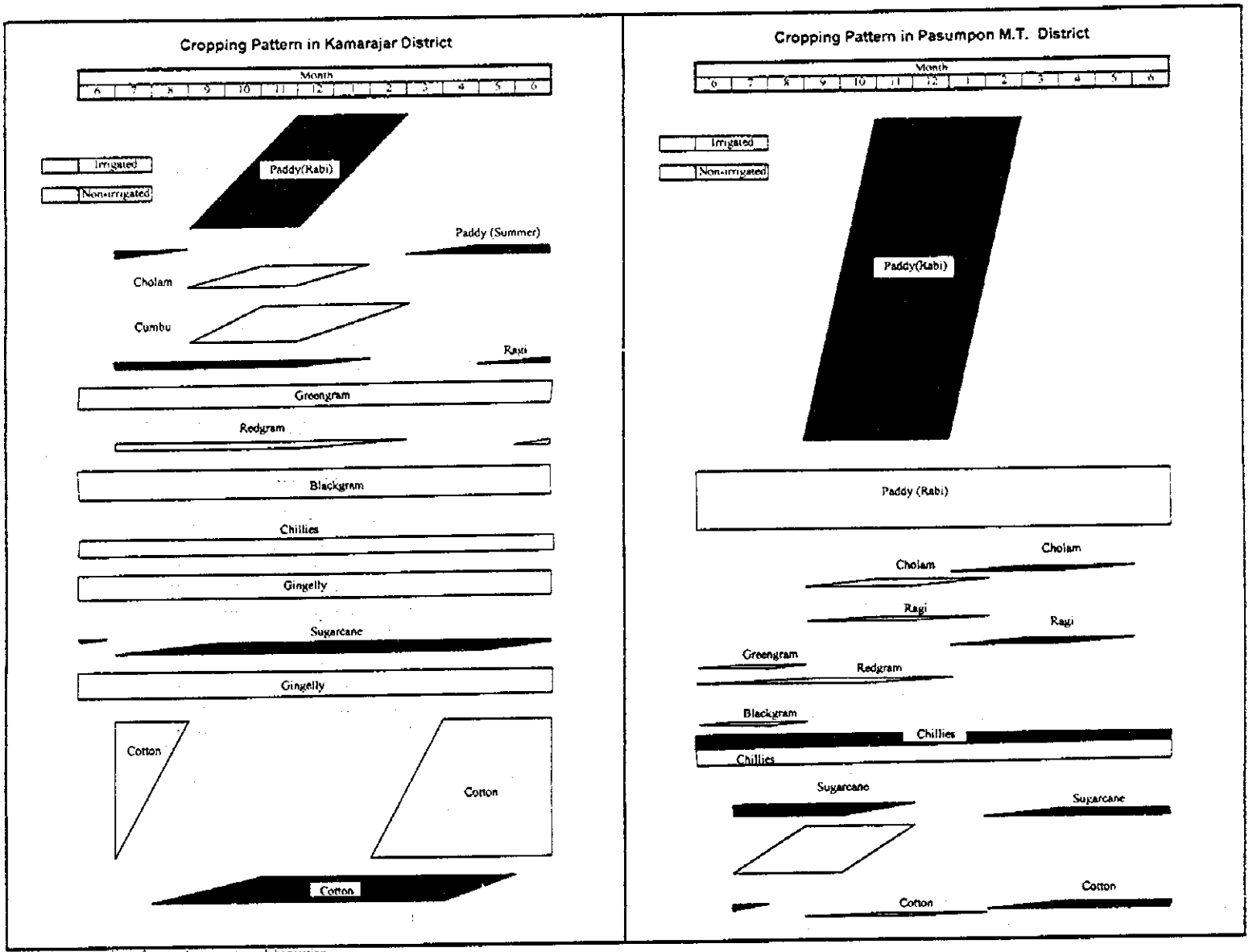



Fig. 3.2.4 SOIL ORDER IN THE SOUTHESTUDY AREA




* Cropping season shows from peak sowing to peak harvesting
Source: Season and Crop Report of TAMIL NADU

**Fig. 3.3.1 Cropping Pattern in the Study Area (2/2)**




* Cropping season shows from peak sowing to peak harvesting
Source: Season and Crop Report of TAMIL NADU

**Fig. 3.3.1 Cropping Pattern in the Study Area (2/2)**

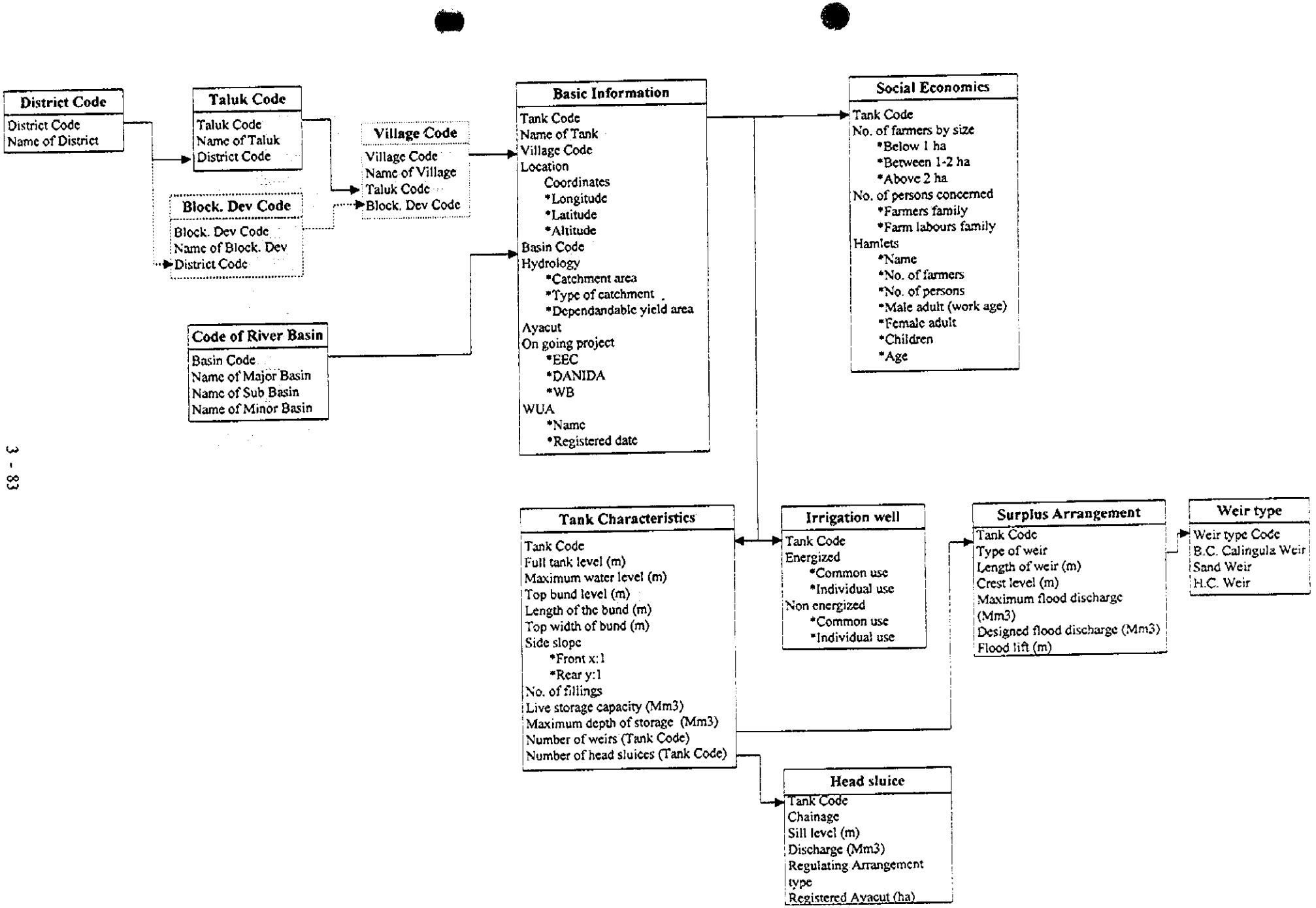



**Fig. 3.6.1 Design Concept of Tank Database System**

# CHAPTER 4 : THE MASTER PLAN

# CHAPTER 4 THE MASTER PLAN

## 4.1 Objectives of the Master Plan

One of the objectives of the Study is to formulate the Master Plan for rehabilitation of minor irrigation tanks for rural development.

The objectives of the Master Plan is to increase the agricultural production and to improve living standard of farmers, especially small holding farmers, through the rehabilitation of minor irrigation tanks. As shown in Fig. 4.1.1, it can be achieved by the following activities:

1) Maximization of water utilization by rehabilitation of tank irrigation facilities and introduction of proper O&M system, and

2) Introduction of sustainable agricultural development by appropriate cultivation system, proper inputs for agricultural production including the irrigation, qualified seeds, fertilizer/chemicals, and supporting system.

The Master Plan for Rehabilitation of Minor Irrigation Tanks was formulated considering the 8th Five-Year Development Plan. The following items are considered for the formulation of the Master Plan:

(1) Importance and significance of the rehabilitation of minor irrigation tanks in the Tamil Nadu State
(2) Natural conditions and land use plan including utilization of water resources and watershed protection
(3) Basic concepts for promoting agriculture in a suitable manner for the Tamil Nadu State
(4) Production target and promoted variety suitable for the rural conditions including farming practices and cropping
(5) Rehabilitation of tanks and related facilities such as irrigation and drainage facilities
(6) Operation and maintenance of the facilities including rehabilitation plans
(7) Water management
(8) Farmers' participation and organizations
(9) Agricultural extension
(10) Agricultural supporting services
(11) Human resources development including gender issue
(12) Environmental conservation

In formulating the plan, several studies were carried out as required clarifying the target years, and in the human resources development plan of PWD and farmers, capacity of the development, budgets, implementation period, and relation between rehabilitation of tank facilities and human development were elaborated.

## 4.2 Basic Strategy

### 4.2.1 Present Constraints

Based on the results of field survey, the present conditions of the Study Area are grasped, and the development potential and constraints for rehabilitation of minor irrigation tanks were analyzed. The following characteristics and problems of natural, social and economical conditions were analyzed for the respective categories.

- Existing conditions of damages on tanks and related irrigation facilities
- Structure of poverty and regional difference (present situation of marginal and landless farmers)
- Needs of beneficial farmers
- Agricultural supporting services
- Farmers' organization and human resources
- Marketing and distribution systems
- Existing development projects and schemes

The present constraints are mentioned below:

(1) Shortage of Stored Water in the Tank

According to the Tank Baseline Survey prepared by Statistical Department in 1995, the cultivation in most drought prone district of Virudunagar shows the average surplus water year is only 1.5 years within last 5 years. This figure was confirmed through the site inspection which show the semi-arid vegetation in the area. Also the district shows the most high ratio of cultivated area irrigated by groundwater in the State. The agriculture under rainfed tank irrigation is actually rainfed cultivation. Even if water is stored in the tank, it remains maximum for 6 months in the Northern Study Area, and mostly for 3 months in the Southern Study Area. Also the shortage of stored water in tanks is caused by the deterioration of catchment areas on their ground surface coverage, reduction of water inflow through supply channel and live water storage capacity by siltation, and over-installation of tanks in the area.

(2) Deterioration of Tank Irrigation Facilities

Most of minor irrigation tanks were constructed long time ago. After the declination of traditional maintenance system, no proper maintenance was implemented for the tank facilities including catchment treatment by farmers. The tank bund sometimes destroyed by cattle and the shoulder of narrow crest and steep slope of bund are eroded by rainfall. The water distribution system, especially sluices, are not properly operated because of poor maintenance and poor water storage in tank. Seepage through the narrow tank bund is common during the period of high water level stage of the tank. As a matter of fact, the cultivation fields near to the bund show wet or in poor drainage condition, especially in the Northern Study Area.

(3) Poor Irrigation Management

Irrigation channel in the command area is an earth channel, and diversion or intake to the fields is made by temporary earth banking. It results in high conveyance losses. Sometimes sluices are let opened to have full water flowing even during the heavy rain.

(4) Farmers' Strong Intention for Paddy Cultivation

The farming in the Study Area is extremely affected by the unstable weather conditions with the limited water sources. Agriculture of marginal and small scale farmers' is mainly self-consumptive food-cultivation. Therefore they want to cultivate paddy as a first priority. The areas with annual rainfall less than 800 mm, like the Southern Study Area, are critical for paddy cultivation. Farmers are waiting for sufficient rainfall to cultivate paddy for 3 years in the Southern Area without cultivating other crops in their fields.

(5) Poor Coordination of Water Distribution among Chained Tanks

Most of minor irrigation tanks are chained each other, and self catchment area of one tank is the command area of upper tanks, and both tanks are connected by the surplus or supply channels. Under these conditions, water distribution and tank storage operation shall be coordinated each other. There is no such coordination body within the present chained tank basin.

(6) Lack of Awareness of Community Property

After fading out of traditional maintenance system under the strong leadership, farmers lost their awareness that tank and irrigation facilities are their property. They intend to rely on the government assistance for operation and maintenance.

(7) Poor Accessibility to Market

Sometimes the harvesting of first paddy is under the rainy days, the harvested paddy shall be transported to the village through the pond and muddy poor paths. It results in the increase of yield losses. Also agricultural products shall be transported to the market through the submerged paths with cattle cart, in case of being sold in market. Besides, except for some basic produces, the fluctuating pricing system affects the scale of agricultural productions.

### 4.2.2 Basic Concepts of the Master Plan

(1) General

The Minor Tank Rehabilitation Project is considered to be an extension of the on-going EC Tank Modernization Project which is for rehabilitating and modernizing tanks for the smooth implementation. Then basic concepts on irrigation tank development of the government need not to be changed. Therefore, under good coordination of government agencies the development project shall be implemented efficiently.

Based on the development potentials and constraints for agricultural development under the frame work of minor irrigation tanks in the Study Area, the following points shall be achieved by the Project

(2) Basic Consideration for Formulation of Master Plan

The following items were considered in establishing the basic concepts:

- As shown in Fig.4.2.1, the final objective of the Project is to improve the farmers' living standards in rural areas through the rehabilitation and improvement of minor irrigation tanks. Since most of the low-income farmers in the Study Area consists of marginal and small scale farmers, it is important to increase agricultural production and to improve the living standards of such marginal and small scale farmers in order to solve the poverty problem in the area. Therefore, the development plans of each sector have to be established so as to improve agricultural productivity by supporting and reinforcing the present organizations for better farming practices, operation and maintenance, water management, etc.

- The development targets, scenarios and strategies were set for each sector clarifying the overall development target and the long and middle term target years.

(3) Basic Concepts of the Master Plan

1) Maximization of Water Resources for Minor Tank Irrigation System

- requirement of hydrological and hydra-geological analysis not only the surface water sources but also groundwater sources in the chained water basin
- conjunctive use of water (through community irrigation wells) especially in the Southern Study Area
- improvement of the irrigation system in the command area to reduce the water losses
- elaboration of most productive and economical crops per unit water consumption

- motivation of farmers for water saving in irrigation
- introduction of water saving irrigation system (sprinkler, drip irrigation)
- catchment treatment of tanks, watershed management
- preparation for farmers participation to the Project from the initial stage
- formulation of WUA and combining with individual tanks

2) Establishment of Method for Rehabilitation of Minor Irrigation Tank in the State

- rehabilitation of irrigation facilities, such as bund itself, sluices, shutters,
- remodeling of sluices structures
- farmers' participation for reformation of traditional self-help
- motivation of farmers as beneficiary of tank proprietor
- synergetic effects to rural development

3) Formulate Improvement of Irrigation/drainage Facilities

- canal lining and measurement devices, and gate controlled diversion box
- provide drains at the toe of bund of tank
- provide drainage
- formulation of manual for flood fighting and emergency repair

4) Farmers' Participation for Efficient Operation and Maintenance

- farmers participation from the planning stage.
- strengthening community organizer (CO) system for water management effectiveness
- strengthening IMTI for supporting farmers' activities

5) Establishment of Sustainable Agricultural Production System

- introduction of most profitable crops under irrigation conditions with consideration of water requirements and growing periods of the crops
- introduction of most profitable crops under rainfed conditions
- suitable irrigation method by crop including drip irrigation method
- consideration to agricultural labor quality and quantity
- development of agricultural processing
- improvement of marketing system
- improvement of distribution system of products
- strengthening farming loan schemes
- strengthening of technology on extension system
- formulation of growers' association
- environmental conservation

6) Improvement of Rural Infrastructure for Agricultural Development

- access to the market and from fields to villages
- utilization of tank bund as O&M roads along the toe of bund including improvement of rural environment
- mechanization of some agricultural works

7) Institutional Development for the Project Implementation

- organization of Project management system
- programmes for improving rural living conditions including WID
- governmental measures for supporting the Project implementation

(4) Target Year of the Plan

The country and State have no significant long term plan for agricultural and water resources development except 5 year plans up to now. Considering the following data, about 2100 PWD rainfed tanks in the Study Area will be rehabilitated within 13 years or by the year of 2011 as a target with introduction of foreign financial assistance:

- Progress of EC Projects, which improved about 600 tanks within 7 years between 1984 and 1995 (annual progress of about 85 tanks), then it need 25 years to cover all tanks in the Project Area. Considering the work condition, distribution of work site, familiarization of implementation by their experience and limited disbursement of the grant fund, the more efficient implementation can be expected for the Project. Then with the introduction of new devices for the preparatory stage such as computerized Feasibility Report Generator, which is formulated by EC Project recently and guideline/manual, it can be estimated that the annual progress of tank rehabilitation increase by more than two times of previous EC Project , it need 13 years by the introduction of foreign funds

- average cost per tank is estimated at Rs.3 million and the annual State budget for the minor irrigation during the 7$^{th}$ and 8$^{th}$ five year plans are at Rs.201 million and Rs.500 million (Rs.160million for EC Project), respectively. If the entire State budget for minor irrigation projects is allocated to this Project at Rs.500 million a year, it takes more than 13 years for tank rehabilitation.

## 4.3. The Master Plan for Rehabilitation of Minor Irrigation Tanks

### 4.3.1 Component of the Master Plan

Based on the basic concepts of the Master Plan, the following components are considered to be included to the Project of Rehabilitation of Minor Irrigation Tank for Rural Development:

(1) Watershed management and total hydrological and assessment of basin of tanks in chain
(2) Conjunctive use of surface and groundwater in the catchment and command area including the sinking community wells for irrigation in the water scarcity area
(3) Rehabilitation and improvement of tank facilities
(4) Efficient irrigation operation and management through canal lining, on-farm development and establishment of water users' association through the community organizer system,
(5) Crop diversification for the improvement of marginal and small scale farmers through cultivation of water-saving and high beneficial crops instead of paddy in the water scarcity area including the demonstration farms,
(6) Strengthening agricultural support and extension to achieve the sustainable agricultural development and crop diversification including agricultural input distribution improvement, agricultural credit and strengthening technical extension services,
(7) Value-adding agricultural products including crop producers association, village industries,
(8) Improvement of rural infrastructures related to the agricultural development such as access roads to cultivation fields and markets, community centers,
(9) Institutional improvement for support the early and easy achievement of the Project plan, including turnover of irrigation system maintenance to the WUAs.

The details of each component are discussed below.

### 4.3.2 Total Water Management in the Chain Tank Basin

More than 20% of land surface is covered by waterspread area of tanks in the Study Area. These high density tank installation caused the tight interaction of hydrological and social conditions. The runoff in watershed arising from monsoon rains is captured in a single or series of tanks linked together and forming chains, such that very little rainfall on the catchment is lost. As successive tanks are constructed down a chain, attention seems to have been bestowed to the respective rights of upstream and downstream users of the tanks, as to how much runoff could be impounded and how much should flow on to others, so that the maximum runoff could be conserved for efficient use later on. The ability to rehabilitate all tanks within a watershed or chain at about the same time, provides a means for resolving these and ensuring that interactive in one tank are not made at the expense of the farmers lower down the system.

Professional Assistance for Development Action (PRADAN) has commenced the study of linkage of tanks hydrologically as well as socially and institutionally in the Southern Study Area under the EC phase II extension. Also AED and DANIDA and other organization are extending the watershed management programmes in the State.

In collaboration with these organizations, the Project shall be implemented hydrological and social study for the sustainable water resources and agricultural development.

### 4.3.3 Conjunctive Use of Water Sources

(1) Need for Sinking Community Wells in Tank Command Area

The irrigation tanks do not only serve the purpose of storage for irrigation and flood control, but also for recharging the aquifers. Because of poor management and maintenance of tanks and their apparatus, tanks are deteriorated and reduce the original function to irrigate whole command area. For example, Srivailliputhur Big Tank in Ramanathapuram, the tank surpluses on average once in 10 years as shown below:

| Tank storage | Storage level (%) | Probability* |
|---|---|---|
| Surplus | more than 100 | 0.1 |
| Full | 70 to 100 | 0.2 |
| Deficit | 50 to 70 | 0.5 |
| Very low | less than 50 | 0.2 |

Source: K. Palamisani etc. Economics of Irrigation Planning-Application of Simulation Models, Sep 1995

* based on a 46 years' rainfall data

Most tanks in the Southern Study Area need more than one filling to grow one crop. This results arose the necessity of alternative water sources to save the crops at their crucial stages. This situation has prompted the affluent farmers to invest on wells for groundwater exploitation especially during the past two decades. So the need for more wells in the command area to meet the requirement of poor farmers particularly at the tail end still continues.

(2) Effectiveness of Well Installation for Tank Irrigation

According to the simulation model study by Prof. Palanisami on Srivilliputhur Big Tank in Ramanathapuram, improvement strategies of tank rehabilitation / modernization were evaluated and concluded the investment strategy of sluice and rotation management, canal lining and well development is most recommendable. The evaluation was made at the productivity measured by the production ratio between with and without improvement, and equity, measured by the ratio of net return between head farm and tail farm as shown below:

| Investment Strategies | Productivity Ratio | Equity Ratio | IRR |
|---|---|---|---|
| Sluice improvement | 1.0 | | 0 |
| Sluice management | 1.1 | 2.6 | 2,204 |
| Canal lining | 1.3 | 1.6 | 63 |
| Additional wells | 1.3 | 1.5 | 38 |
| Rotational management | 1.4 | 1.5 | 1,974 |
| Canal lining + Add. Wells | 1.4 | 1.0 | 33 |
| Sluice mangt. + Canal Lining + Add. Wells | 1.5 | 1.2 | 39 |
| Rotation mangt + Canal lining + Add. wells | 1.5 | 1.2 | 31 |

Remarks : productivity ratio more than 1.0 is favorable and equity ratio 1.0 is most favorable.
IRR is estimated as the useful life 11 to 16 years
Source : Economics of Irrigation Planning-Application of Simulation Models, TNAU, Sep. 1995

(3) Potential of Groundwater Sources

The availability groundwater in many of the tank command areas is limited due to geologic nature of underground formation (hard rock) which constitute the aquifer. The major sources of recharge for these aquifers are:

- downward or lateral seepage from tank
- downward percolation from the channels and irrigated paddy fields
- the yield of wells in command area is mainly dependent on the tank storage. The well facilitate capturing and re-use of portion of irrigation water lost by deep percolation from the irrigated rice fields and from tanks

Wells have become necessary to off-set the vagaries of monsoon in the command area. But wells are owned by large and rich farmers, since the initial investment costs are not within the reach of marginal and small farmers whose number accounts for 80 to 90% of total number of farmers though the total extent owned by such farmers is in the range of 30 to 40 % of the total tank command area.

Considering the potential of groundwater resources in the tank command area which receive good replenishment not only from rainfall and tank storage, but also from the applied irrigation water, sinking community wells for irrigation, spaced appropriately in the middle and tail reaches will be quite helpful for the poor farmers to tide over the water scarcity experienced during certain periods of the year. This will also help in capturing and re-using a portion of irrigation water lost by deep percolation from the irrigated rice field and effective use of carry-over storage in good years during the second crop season.

As stated in Chapter 3, the northern part of Northern Study Area, such as Poondi, Minjur, Thiruvallur and adjacent are over exploited area, and some area in Kamarajar district is groundwater scarcity area, such as Rajapalayam, Vatrap and Srivilliputhur. Some of coastal area of both Study Areas are facing the sea water intrusion caused by over extraction of fresh aquifer. Groundwater in Ramanathapuram district was observed to be high salinity water (EC 0.75 - 2.25 dS/m) by the JICA Study Team in Dec. 1996. These area shall be carefully studied before installation of wells and to be properly managed during the well operation.

(4) Community Wells for Irrigation

According to the survey by CWR of Anna University, the wells command area in tank command area varies from 2 to 3.5 ha/well and from 0.7 to 2.0 ha-cropped /well. From hydrologic and management point of view, it is said that a 4 ha of command area by a well is reasonable even in deficit year (Palanisami, et al. "Economics of Irrigation Planning-Application of Simulation Models", Sep. 1995)

The community irrigation wells are necessary to be maintained by the farmers. The

maintenance of such wells is to be entrusted with the users who have to form a society with legal status for entering into agreement with PWD for proper upkeep and maintenance of the community wells. Before going for implementation, modernization works are to be decided duly considering the following points:

- estimate groundwater development potential by water balance analysis within the total catchment area of tanks chained
- confirmation of groundwater suitability on the salinity, sea water intrusion
- willingness of the farmers to use community irrigation wells and maintain them according to the norms to be prescribed by the PWD
- selection of sites for wells and type of well and norms for using the community well
- availability of power connection, etc.

### 4.3.4 Farmer's Participation

(1) General

Tamil Nadu is fortunate to inherit such valuable irrigation works as tank irrigation system which are, even after hundreds of years, in usable conditions. This is possible because, the traditional and informal farmers' organizations were able to maintain these tanks with a sense of collective ownership on them until a few decades back. The farmer beneficiaries contributed labour for desilting and maintaining the water-courses and irrigation channels and this practice is called '*Kudimaramath*'. However, in Tamil Nadu, since the possession of tanks were transferred to the governmental organization such as Pahchayat union, PWD, etc., the farmers have used and operated them but have been placed away from maintenance duties. The maintenance works have long been taken care of by the government organizations as their duties.

Under these circumstances, the irrigation management turnover is proposed to be transferred from the government organization to WUA as a prerequisite for modernizing the irrigation facilities. By the turnover of irrigation facilities, only the responsibility of water management is transferred to WUAs leaving the irrigation facilities as a property of the government. In order to provide desired irrigation service to the farmers, it is imperative that the control, operation and maintenance, and management of the system must be transferred to the farmers smoothly in such manner that the farmers can accept easily.

To assure the smooth turnover of the irrigation facilities, it is indispensable to develop and organize the farmers into the strong and cohesive WUAs. Since the sociological conditions vary widely from village to village, the WUAs to be formed must fit these conditions in organizational aspect as well as in procedural aspect.

(2) Importance of Farmer's Participation

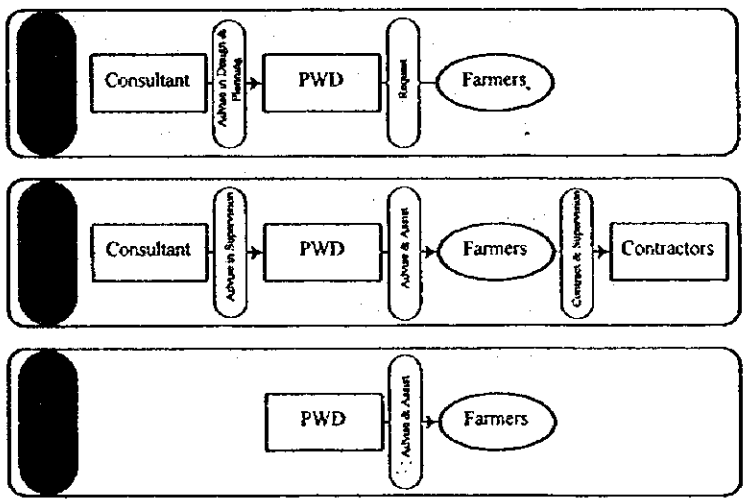
The tank irrigation system are smaller in size and larger in numbers with wider geographical distribution. Water management below the tank can not be viewed as purely technical one, since it encompasses essentially a social phenomenon and in the absence of its adequate understanding, methods of distribution and utilization of water are not going to be very satisfactory. Hence, the tank system has to be managed inevitable by the users themselves, since their management by a government agency will result in huge organizational expenditure, the effective and efficiency of the system depend on the involvement of the users only.

As infrastructure improvement measures, lining of canals and on-farm development are proposed to achieve an efficient irrigation operation and management and to attain the sustainable agricultural development. To realize such sustainable agriculture under the rainfed tank irrigation, it is considered to be indispensable to involve the beneficial farmers in planning, implementation and operation and maintenance of those proposed measures.

No ayacut area has a formalized organization for water distribution in the selected pilot tanks. In most of the ayacut areas, the village headman or similar leader of the irrigation group informally functions as the leader of the community with took all the decisions. The common irrigator called *Neerkatti* takes care of the distribution following the prescribed turns and is usually paid in kind. Disputes are resolved by the headman by himself or through discussions in a group. In some tank ayacut areas, the maintenance works of irrigation facilities are carried out by the farmers in the ayacut areas at the initial stage of the irrigation season.

As for the agricultural credit system, some villages have agricultural cooperative association or bank to assist the farmers in providing the crop loans. Most of the farmers get such assistance.

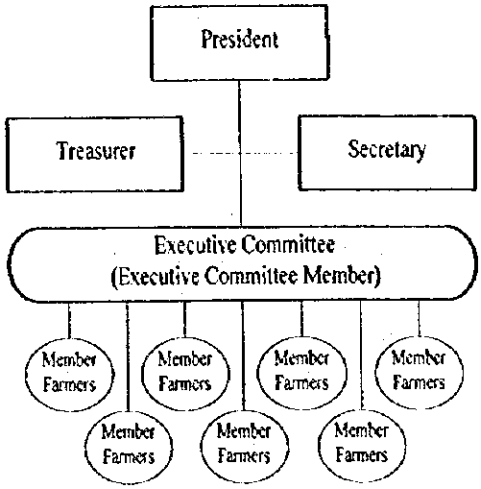
Farmers participation at the planning and design stage, rehabilitation construction stage and O&M stages are considered as follows:




CONCEPTUAL FORMATION FOR PROJECT IMPLEMENTATION

(3) Proposed Farmers Organization for Water Distribution

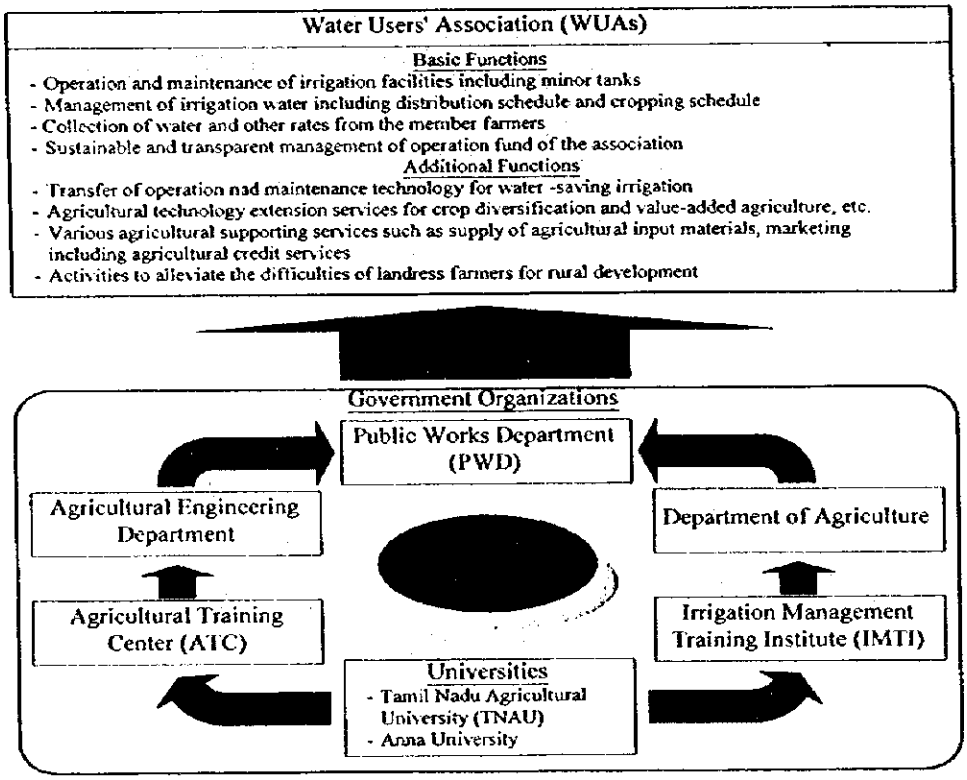
As shown in the organization chart, the WUA is headed by the President who is selected by election, and the President is supported by the Treasurer and the Secretary are also selected by election. Under the President, the Executive Committee is formed to lead the member farmers and to discuss on various subjects during the operation. At least five (5) committee members are selected by election according to the number of member farmers belonging to the association. One (1) committee member is so selected that he represents about 30 member farmers.




PROPOSED ORGANIZATION CHART FOR WATER USERS' ASSOCIATION

(4) Proposed Functions of WUAs

Proposed function of WUAs are summarized in the following figures.




FUNCTIONS OF WUA AND RELATED ORGANIZATION

(5) Formation Procedures of WUAs

The WUAs have to be formulated in a manner that the farmers in the ayacut areas can accept easily so as to fit the present social conditions. The process to formalize the WUAs is that to organize the ayacut community. Therefore, the various activities of the community organizer are essential to carry out the process successfully.

The procedures for formalizing WUAs are divided into the following two (2) stages.

- Preliminary meeting stage to find and organize the potential farmers who are considered interested in formalizing WUA
- General body meeting stage to elect office bearers

According to the existing schemes which have been implemented by PWD, three (3) or four (4) months are necessary to formalize WUA in an ayacut area though such periods may be different from scheme to scheme depending on the farmers' adaptability and sociological situations of the ayacut areas. Therefore, it is necessary to take into the account the period required for formalizing WUA in the implementation planning. The community organizers' attendance is recommended to be prepared at least six (6) months before the actual implementation of rehabilitation works.

(6) Needs of Community Organizer

The success of any water management program lies in the hands of the farmers, whatever might be the credibility of the policies and strategies that might be proposed in a command area for initiating a good water management program. In other words, without the farmers total involvement any attempt to implement a water management program might not yield the desired results. The community organizer are proposed to be assigned to mitigate and solve the various constraints which are considered to take place in formulating the proper WUAs as well as in operation and maintenance. The community organizers are proposed to play a vital role in building a situation ideal for the total involvement of the farmers. The following task accomplishments are proposed for the community organizers.

Matrix for Community Organization

| Activities | Process | Factors | Outcome |
|---|---|---|---|
| Integration and Social Investigation | | | |
| i) Integration and Familiarization<br>ii) Creating Participatory Awareness | - Living with community<br>- Familiarization of village and tank<br>- Contacts with individuals, group and local officials<br>- Meeting with community leaders<br>- Street corner meetings<br>- Field meetings with farmers | - Caste system<br>- Village spread and hamlets<br>- Literacy<br>- Tradition and culture | - Social acceptance<br>- Interest creation among community towards participatory concept and need for group action<br>- Strategy design for motivation and development of WUA |
| iii) Social Investigation | - Collection and analysis of primary and secondary data<br>- Studying the inherited social relationship between different caste, hamlets and village<br>- Understanding farmers' problems and their response and behavior towards tank irrigation | - Data availability<br>- Social equation between hamlets and village and between different caste groups<br>- Leadership quality | - Emergence of a realistic social spectrum<br>- Understanding of tank problems<br>- Better understanding of the behavior of sharing common property resource and farmers' perception towards sharing of tank water<br>- Scope to refine the strategy towards motivation |
| Animation | | | |
| i) Identification of a Leader | - Organizing group discussions<br>- Skill testing among different potential farmers by assigning task accomplishment<br>- Open discussions on common issues and developing skill on decision making<br>- Free interaction among farmers in task accomplishment and decision making results in emergence of potential leaders | - Existing social relationship between village and hamlets<br>- Power polarization between different caste groups<br>- Traditional leadership and its role | - Emergence of acceptable leadership |
| ii) Organizing Farmers through Meetings | - Motivate and facilitate better interaction among leaders and farmers<br>- Organize discussions to elicit different views of approach among farmers<br>- Initiate process to crystallize consensus on issues by entry program, exposure visits, etc | - Prevalent social system<br>- Tradition<br>- economic benefits | - Awareness on the benefits of unified action<br>- Realization of the need to organize<br>- Designing the steps to organize |
| Formulation of Water Users Associations (WUAs) | - Membership enrollment by task group members<br>- Hamlet-wise to improve enrollment progress<br>- Formulation of by laws for the WUA by group discussions<br>- Structuring of the association on the composition of the Executive body<br>- Convening the general body meeting with 2/3 representatives to approve the by-laws and to elect/select office bearers<br>- General body also nominates different task groups for specific task accomplishment<br>- Formal registration under the relevant State Government Act | - Eagerness to organize and act with a spirit of accommodation | - Formation of legally constituted Farmers Organization with its task groups |

## (7) Measures and Process for Community Organization

The 'Organization' means some kind of society structured way of working together which is acceptable to almost all the water users and supported by them; it may be formal, loose or under agreed local leadership. The kind and quality of such organizations are influenced by local history, development, village level, social and economic cohesion, hierarchy, etc., and the situations and conditions of these aspects are different from community to community.

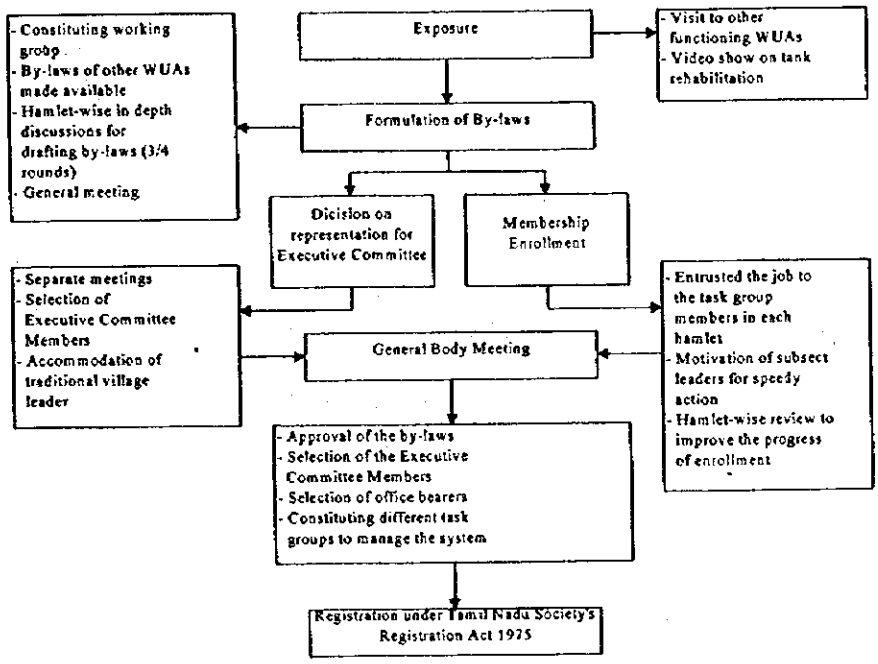
It is necessary to grasp and analyze the socio-economical characteristics and nature of each community in these aspects to organize such community in the most effective and suitable manners as well as to make the organized community sustainable in all the aspects. It is, therefore, proposed to carry out the social investigation before commencing the implementation to find out the socio-economical constraints of each community in the following manner.

The Participatory Rural Appraisal (PRA) is the method being applied for the EC project to select the tanks. It is a means of collecting socio-economic and physical information through close interaction with local inhabitants using various techniques that have been tested and developed by many NGOs in southern India. It is also a systematic approach which helps resource poor communities to articulate their felt needs and prioritize effectively. It enables these communities to take an active role as equal partners in their own development. In addition, it can provide an improved sense of responsibility and ownership by the community in natural resource management and care for the local environment.

The principles of PRA are stated below.

| | | |
|---|---|---|
| i) | Right attitude: | Openness humility, curiosity, sensitivity, acceptance. |
| ii) | Right behavior: | Showing respect, being friendly, Interacting not lecturing |
| iii) | Flexibility: | Not getting into any fixed or rigid method |
| iv) | Seeking diversity: | Looking for variability, contradictions and anomalies rather than standardization |
| v) | Triangulation: | Cross verification |
| vi) | Critical self-awareness: | errors committed must be accepted as an opportunity for doing better |
| vii) | Optimal ignorance: | Restrict to collect the information which are really needed and avoid collecting unnecessary details |
| viii) | Appropriate imprecision: | It is better to be approximately correct rather than precisely wrong |

The formation of Water Users' Association (WUA) is one of the most important target of the community organizers' tasks, of which work flow is presented in the following figure.



(8) Training and Institutional Reinforcement

The training for the community organizer has been conducted mainly in IMTI (Irrigation Management Training Institute) in Trichy and in KVK (Krisi Vigyan Kendrah - Farm Science Center) in Dindigul so far in line with the recommendation by EC assisted schemes. These training are considered to contribute in increasing the number of community organizers. It is, therefore, important to reinforce these training courses so as to furnish the community organizers with various technologies on water-saving irrigation, crop diversification, etc. as well as their original purpose to organize farmers.

CONCEPT OF PROPOSED TRAINING INSTITUTION

The farmers' training is considered to have two (2) aspects; one focuses on the operation and management of the farmers' organization (WUAs) for leading farmers and the other on various farming practices and technologies mainly by the demonstration of such technologies in the experimental farms.

The training for the government staff is proposed to be conducted mainly on the technical and practical issues relating to introducing the new varieties and technology contributing to water-saving irrigation, crop diversification, marketing, etc. The training includes lectures and study tours held by various national and international organizations and institutes.

Various training courses are set for government staff, community organizers and leading farmers by various training agencies such as Agricultural Training Center (ATC), Irrigation Management Training Institute (IMTI), Tamil Nadu Agricultural University (TNAU), Anna University, etc., and it becomes complicated to control these courses. It is necessary to set up an organization to coordinate such training agencies to provide comprehensive training traversing various fields in an integrated training system. Therefore, it is proposed to establish "Management Center of Tank Rehabilitation Training" under the coordination among the Public Works Department, the Department Agriculture and the Agriculture Engineering Department. The center is proposed to be attached to the Irrigation Management Training Institute, which functions as a core agency, and act as an important role in

various coordination among those training agencies.

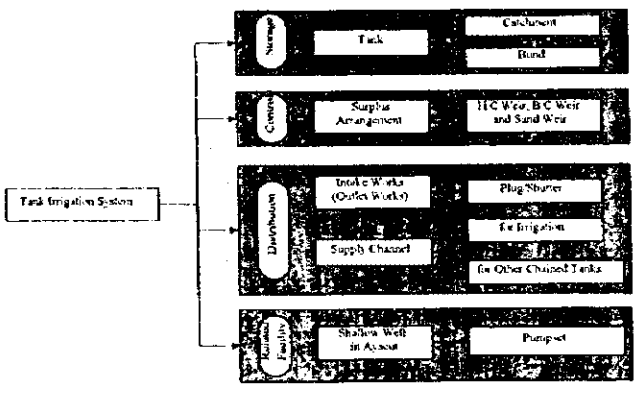
(8) Role of Government Agencies

No effort to promote WUAs can succeed in the country unless the irrigation bureaucracy provides back up efforts to assign the engineers and community organizers playing a role to facilitate this, and unless they take an active role. The whole procedure has more effect on the irrigation establishment than most of the officers will anticipate. The process requires a change of attitude -- from commanding the farmers to facilitating their take-over of responsibilities. It is essential that the irrigation department officers on the spot show sympathy and goodwill when a new WUA has been formed. The following items of support activities are proposed to be provided by the government agencies either directly or through the community organizers.

- Get the WUA on the list of WUAs recognized by government agency.
- Obtain maps or sketches showing all minor canals and control structures, field holdings, channel and water course alignments, sub-blocks, etc.
- Improved field channel alignments as required in view of technical aspects
- Help in preparing *warabandi*, if farmers need the system
- Discuss the water schedule/distribution method including water availability, water allocation, canal scheduling, etc.
- Take administrative arrangements required for getting farmers understood on the determined schedule of water distribution
- Help the WUA collect fees with farmers' confidence issuing receipt etc.
- Allow the WUA to keep a commission on water fees collected for collection work itself, etc. if the member farmers agree it

### 4.3.5 Rehabilitation and Improvement of Irrigation Tank Facilities

Irrigation tank facilities consist of some components as shown in the figure. These components can not be functioning satisfactorily due to unsuited operation and inadequate maintenance and deterioration.
Rehabilitation plan of the irrigation tank facilities are proposed as follows for maximized utilization of water resources.




Component of The Tank Irrigation System

(1) Erosion in the Catchment Area

Erosion is increasing due to non-artificial land use in the catchment area, which are:

- irrigation and livestock for agricultural extension by individual and,
- felling for subsistence commodities.

Siltation by the erosion occurs reducing capacity of both the water detention in the catchment and the tank storage capacity.

Most of existing tank system consists of chained tanks utilizing neighboring catchment areas. Each tank is connected by supply channel. Since inflow of the upper tank are not available due to deterioration of supply channel, tank irrigation system needs own catchment conservation. However, since catchment area extends widely, countermeasures by civil works is not possible. To prevent erosion, the non-infrastructural measures can be taken as stated below

- Minimization of irrigation in the catchment area
- Efforts of reforestation in the catchment area.

(2) Strengthening of Tank Bund

As the crest and the side slope of the tank bund have deteriorated over the years due to erosion, the bund shall be restored and the crest width shall be widened based on the following points:

- front slope 1.5 : 1 (Horizontal : Vertical)
- rear slope 2.0 : 1 (Horizontal : Vertical)
- flood lift : 0.6 m
- freeboard : 1.00 m to 2.00 m
- crest width : 2.00 m in case of road along bund exist, and 3.00 m without road along bund

The works involved in this component are:

- bringing the bund section to the standard size with the earth excavated from the waterspread area
- protection of front slope wherever necessary with 23 cm or 30 cm thick stone revetment over gravel backing of 10 cm or 15 cm thick. Re-packing of existing stone revetment wherever required
- gravel casing of 10cm thick at the crest wherever the bund is formed with clay soil

(3) Repairs and Reconstruction of Sluices

Since the existing sluices in all tanks have serious operational problems with wastage of water, the improvements made to install control facilities with easy and precise control on water releases contributing to the improvement of performance of the tanks system. No new or additional sluices are proposed in the Plan. The works of sluice repair include the following items:

- repairs to the existing sluices
- reconstruction of badly damaged sluices or those with non-standard barrels. The pipe sluices mostly with 30 cm dia, are replaced with barrels of 0.6 m wide and 0.75 m high constructed of masonry on sides and reinforced concrete slab on top and concrete on bottom
- provision of screw-gearing shutter (slide gates) or plug and screw gearing rod arrangement for the easy and accurate sluices operation

(4) Repairs and Construction of Surplus Arrangement

Three (3) types of surplus arrangements are provided at present as briefed below.

- B.C. Weir: Block Costalvia weir is constructed by brick and cement mortal.
- H.C. Weir: High Coefficient Weir is constructed by brick, stone and cement mortar.
- Sand Weir:

Due to deterioration by poor maintenance and surplus water exceeding design value, these arrangements are in deplorable condition such as collapse of the crest and the guide wall. Since full tank level becomes lower due to these deterioration, irrigation tanks can not store the design volume.

The following measures are proposed to be taken to ensure the safety passage of surplus water.

- Reconstruction of the weir to prevent the leakage from the apron.
- Widening of the crest to ensure passage of surplus water.
- Clogging of the apron by cement mortar

(5) Improvement of Supply Channel

The supply channels are also in deplorable condition as same as surplus arrangements. Therefore supply channel can not convey surplus water from upper stream to tanks.

Tank irrigation system which has scarcity of irrigation water resource needs to utilize surplus water from upstream tanks as much as possible. However, as described in section 2.2.4, most of the available water resources have been exploited and it is

impossible to increase the total exploited water for rainfed tanks. Under this situation, no measures for rehabilitation/modernization of tanks will be effective without ensuring the inflow by improvement of supply channel.

### 4.3.6 Efficient Irrigation Operation and Maintenance

(1) Channel Lining

As stated in 3.4.4 of this report, the channel lining is the most effective measure to maximize the existing water resources in the command area through the reduction of water losses. The canal lining can save the land for irrigation canal and reduce the maintenance requirements. And it contributes to the equity of water distribution from head farms to tail-end farms.

The cross section of main irrigation channel is generally designed for a duty of 1.7 lit./sec/ha for paddy and 0.9 lit./sec/ha for other crops. For the peak requirement of paddy during land preparation (200mm), it requires about 32 hours when a 10 ha irrigation block irrigated to 1.0 ha by 1ha. Then the peak water requirement continue for about 13 days

At the outlet of sluices, in the beginning point of the irrigation canal measurement devices shall be installed to confirm the accurate irrigation water distribution.
In the EC Tank Modernization Project, stone-slabs, pre-cast concrete slabs, stone or brick masonry are used for lining. The use of pre-cast concrete flume also shall be studied to reduce the construction cost and construction period also obtaining the water tight structures. Also check structures and offtakes together with control gates shall be installed along the main canals. Furthermore, canal crossing structures or farm road culverts shall be provided.

(2) On-farm Development

In order to achieve the efficient irrigation management, the on-farm development (OFD) is fatal, because it is connected directly to actual water users. At present, the OFD works are planned and executed by the Agricultural Engineering Department under the overall control of PWD, and their role is confined to the 10 ha block outlet. According to the social environmental survey conducted by JICA Study Team, most farmers have not shown much interest to the OFD because they feel OFD works will disturb their original field boundaries. Therefore, the OFD shall be planned based on the direct discussion with direct beneficiaries, farmers. The plan includes the following work items:

- lining a portion of field(tertiary) channel with outlets at appropriate location
- construction of diversion boxes with control shutters
- provision of individual inlets to holders and forming new earthen channels so that each holding is directly irrigated instead of plot to plot irrigation

- providing appurtenances such as cart crossings/channel crossings over the lined channels, diversion boxes, etc.

### 4.3.7 Crop Diversification for Sustainable Agricultural Development

It seems that present agriculture in the State is biased to food crop production, especially rice production, in which high water consumption is required. However, considering the agricultural situations in the State such as the limited available water sources, the small size of operational holdings, the high irrigation rate in near limitation and the fortunate temperature, more sustainable and more high profitable farming should be introduced with crop diversification and improved cropping pattern.

It is considered that in the Northern Study Area, profitable vegetables shall be introduced centering around the short duration varieties of rice under irrigated condition. On the other hand in the Southern Study Area, profitable cash crops such as mango tree, turmeric, tamarind, onion and chilies can actively be introduced with the short duration varieties of rice under irrigation or non-irrigation conditions. The concrete plan was arranged after discussion with the staff members of DOA and TNAU and farmers concerned after detailed survey. The data showing gross income by crops in the Study Area and the data showing promising short duration varieties of rice are as shown in table of section 3.3.2 (3).

### 4.3.8 Strengthening of Agricultural Support and Extension

To attain success of the profitable agriculture, strengthening the agricultural support and technology extension is indispensable. The outline is planned as below.

(1) Establishment of Experimental Demonstration Farm (EDF)

One (1) EDF in each 5 district of the Study Area, total 5 of EDFs will be established. The activities of the EDFs are verification and demonstration of new technology / new varieties / new crops and farmers' training.

The verification experiments include not only evaluation of the crop production technology but also economic evaluation of the technology. The main subjects to be verified are:

1) Suitability and productivity of new varieties/crops.
2) Economic evaluation of the new varieties/crops.
3) Farming evaluation of new technology and new cropping patterns.

(2) Supply of Agricultural Input Materials

Timely supply system of new seeds and seedlings to the required farmers is important. Especially, on the special materials such as turmeric, grafted tamarind and mango,

propagation activities of the seedlings by the government agency will be needed.

(3) Development of Markets

The government agency concerned will support the growers on the development of markets for new agricultural products and the market price information.

(4) Establishment of Farmers' Organization

Keeping pace with introduction of cash crops, establishment of growers' association will become important. The government agency concerned needs to support the establishment of growers' association.

### 4.3.9 Value-adding Agricultural Products

In order to increase the value of the agricultural products for the farmers under the Project, the following actions shall be studied and installed as a value-adding agricultural products in EDFs by DOA.

(1) Processing of dried mango chips
(2) Canned/packed mango juice
(3) Tomato juice
(4) Bottled vegetable pickles
(5) Powdered turmeric
(6) Dried banana chips
(7) Roasted peanuts
(8) Bottled tamarind paste
(9) Prevention of grain loss by improved post harvest

### 4.3.10 Improvement of Rural Infrastructures

As described in the section 3.1.4, the most of the existing rural infrastructures are considered sufficient for the farmers' living in rural areas, but the following infrastructures are proposed to be provided to facilitate the envisaged project effects.

(1) Community Hall

A community hall is proposed to be provided for each village of the tank system. As explained in the succeeding sections, various activities are envisaged for the institutional development. The following functions and activities are proposed to be conducted in such community hall.

For the core member of WUA
- Meetings relating to the water distribution in the command areas
- Meetings for operation and maintenance of the tank irrigation systems

For the local farmers and inhabitants

- Extension of new technology relating to crop diversification and value-added programs
- Lectures on various aspects relating to family planning, better diet, health and nutrition, literacy, etc. targeting youth and women in the village

(2) Agricultural Feeder Roads and Farm Roads

There exists no farm road in cultivated areas to approach the irrigated farm. It is proposed to provide farm roads with a width wide enough to enable the bullock cart to pass in order to facilitate carrying out the harvested crops.

In addition, it is also proposed to improve the feeder road to main roads running near the village in order to facilitate the effective access to market places. The improvement will include pavement of road surface, widening of road, etc.

### 4.3.11 Institutional Development for the Project Implementation

(1) General

In general, the programs of institutional development are composed of 2 parts: the organization on management and O&M. for the core body of the Project, and the organization and operation of related programs for farmers and local inhabitants to carry out smoothly and realize the Project components.

(2) Organization for Institutional Development

For the management and O&M in the phase of construction and installation, the formation of related committees, e.g. from central level with the Central Steering Committee for directives and controlling works to local bodies at each construction site with Site Office for implementation and field supervision of works related to construction and installation of project structures and facilities.

For the management and O&M in the phase of project-operation, the formation of the farmers' organizations with each core competent personnel for each site and their union-organization in each region shall be carried out simultaneously so that the management for project operation can be properly handled by farmers themselves when the Project is handed over to them.