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**June-2013**

Multi color

**Dr. B.V.PATIL**
**Vice-Chancellor**

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## FOREWORD

Monocropping of paddy-paddy system in the last 2-3 decade has aggravated the problem soil salinity and water logging especially in the low lying areas in the irrigation command. Typical undulating topography, excessive irrigation with absence/improper drainage facilities, seepage and percolation losses from poorly lined canals etc., of the irrigation command are also considered to be the major reasons contributing to water logging and soil salinity.

Nearly 1.0 lakh ha land in Thungabhadra command area is being affected by water logging and salinity greatly affecting the overall agricultural productivity of the command. Lowering of water table and thus keeping the plant root zone free from excessive soluble salts can make land productive. Sub-surface drainage technology is one of the scientific interventions to reclaim and overcome the problems associated with water logged and saline soils in the irrigation command.

A pilot study conducted on the effect of sub surface drainage system on crop yield, soil salinity and water table depth in TBP command at D-36/1 distributory canal near Virupapur village, Sindhanur by the scientists of AICRP on Management of Salt Affected Soils, ARS, Gangavati is certainly a path for future line of research. I compliment the research team on their work and bringing the outcome of this pilot study as a research bulletin entitled "Sub-surface drainage system on crop yield, soil salinity and water table depth in TBP Command – A pilot study". I hope this bulletin provides ample basic information for the researcher, students, extension personnel, farmers and policy makers in attempting reclamation of water logged and saline soils.

Date: 12-06-2013

Place: Raichur

(Dr. B.V.PATIL)
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## PREFACE

Irrigation of crops in arid and semi-arid regions has been a boost in enhancing agricultural production. However, due to unscientific land and water management practices in paddy-paddy cropping system coupled with lack of adequate drainage especially in heavy clay soil, problems of water logging and soil salinity are continued to expand in the TBP irrigation command. It is reported that nearly 1.0 lakh ha productive agricultural land in TBP command is being affected by water logging and soil salinity and a significant area is being added every year.

The yield levels of these soils constrained by waterlogging and salinity are far below the level anticipated for irrigated lands. Site specific interventions are required for reclamation of such lands to their original productivity. Lowering of water table and keeping the soil salinity effects minimum, subsurface drainage technology is considered to be one of the important scientific intervention. However, field drainage requirements depend on surface features, soil type and soil hydrological parameters. A pilot study on subsurface drainage technology on the reclamation of water logged saline soils carried out by the scientists at AICRP on management of salt affected soils and use of saline water in agriculture is perhaps the leading research work in the area of subsurface drainage technology in the region.

I appreciate and compliment the scientists of the centre for carrying out a very fundamental research and the authors for bringing out the results of the research as a technical bulletin entitled "Sub surface drainage system on crop yield, soil salinity and water table depth in TBP Command – A pilot study". The authors have tried effectively to make this bulletin usable at all levels by providing insight into various aspects of sub-surface drainage system including pre-drainage site characteristics, design criteria, installation and monitoring, post-drainage evaluation of soil status and crop yield, nitrogen losses and the last but certainly not the least, the economic analysis of the technology with payback duration.

I certainly hope this will pave the path for students, researcher, farmers, extension workers and policy makers interested in enhancing agricultural productivity in the command through reclamation of waterlogged saline soils.

Date: 12-06-2013
Place: Raichur

(Dr.B.S.Janagoudar)
DIRECTOR OF RESEARCH



Multi color

**ACKNOWLEDGEMENT**

The authors wish to express their sincere gratitude to Dr. B.V. Patil, Hon'ble Vice-Chancellor, Dr. B.S. Janagoudar, Director of Research, formerly Directors of Research and Dr. I. Shankergoud, Associate Director of Research, UAS Raichur, for their continuous support, encouragement and valuable guidance in carrying out the research work and in bringing out this bulletin.

The authors are also indebted to Dr. D.K. Sharma, Director, formerly Directors, CSSRI, Karnal and Dr. S.K. Ambast, Project Coordinator, formerly Project Coordinators, AICRP-SAS&USW, CSSRI, Karnal, for their technical guidance, encouragement and monitoring the activities of the research project.

Our acknowledgement is incomplete without expressing sincere special thanks to formerly Principal Scientist & Head and scientists associated with this work at AICRP-SAS&USW, Gangavati centre.

AUTHORS

## 1. Preamble

Tungabhadra Irrigation Project (TBP) is a major inter-state irrigation project of peninsular India. It was commissioned in 1953 with an irrigation potential of 0.363 million ha in the state of Karnataka and 0.16 million ha in the state of Andhra Pradesh. The project was conceived and planned to provide protective irrigation to light irrigated crops. After the introduction of irrigation, the ill effects of water logging and soil salinity were overwhelming in the TBP command area due to many reasons. The extent of the problem, which was only 20,200 ha during 1979-80, has risen to over 80,000 ha during 1996-97(Anon., 1997) and since 1979-80, it was believed that the area under water logging and soil salinization is increasing at a rate of 3,000 ha per annum. Canal seepage was believed to be one of the major causes of water logging and soil salinization. At a particular site in the command, which has a typical terrain as that of the irrigation command, groundwater table is raising at a rate of 10 cm per year (Manjunath et al., 2001). Furthermore, the use of poor quality groundwater for irrigation has added a new dimension to the problem of soil salinization. Hence, there was an urgent need to find a solution to the alarming ill effects of canal seepage through waterlogging and salinization in the command. A pilot study (1998-99 to 2005-06) was undertaken by TBP CADA and monitored by AICRP on Managament of Salt affected soils at ARS, Gangavathi at distibutary-36 (D-36/1) near Virupapur village, Sindhanur taluk, Raichur district in Karnataka to test the performance of sub surface drainage system on arresting waterlogging, soil salinity, water table depth and thus increase in crop yield.

## 2. Description of the experimental site

A sub surface drainage system was laid to intercept the incoming seepage flows from canal and prevent water logging and soil salinization in low laying areas near Sindhanur during 1998 covering an area of 62 ha. The study area was located within the command area of the Tungabhadra project in the left bank main canal on D-36/1 distributory canal near Virupapur village, Sindhanur. This distributory canal runs on a well-defined ridge perpendicular to the main canal. Site characteristics of the study area reveal that it represents a typical undulating terrain, which also holds for the whole command area. Soils of the area are mainly Vertisols (over 85%) but occasionally red soils are also found on the ridges, covering 10 to 15% of the command. Vertisols contain

40-45% montmorillonitic clay and have high moisture holding capacity with low infiltration rates of 0.02 to 0.2 m/day measured with double ring infiltrometer method. In general, the soil depth varied from 45 cm to 90 cm. However, soil depth is greater than 90 cm near the ridges in the terrain. Soils of this command have a sub-soil of weathered calcareous parent material, locally called murram, which ranges between depths of 1.0-2.5m. Below this depth is hard, impervious, partially weathered granite gneiss. Soils are low in organic matter (< 0.5%) with pH ranging from 7.5 to 8.8. Soils have poor hydrological characteristics such that the hydraulic conductivity of the surface clay soil ranges from 0.005 to 0.01 m/day (measured with inverse auger hole method) as compared to that of weathered calcareous parent material, which remains in the range of 0.05 to 0.1 m/day (measured with normal auger hole method).

## 3. Methodology

Drains of 10 cm diameter were laid at a depth of 0.75 m. The drains were laid in 1998 parallel to the natural drain (named Vadehalla) and D-36/1 distributory canal (Fig. 1 & 2) at a spacing of 150 m. The first drain was installed at about 400 m from the natural drain and 1500 m from the distributory canal and the third drain was about 100 m away from the natural drain. The drains consist of corrugated perforated PVC pipes with nylon filter.

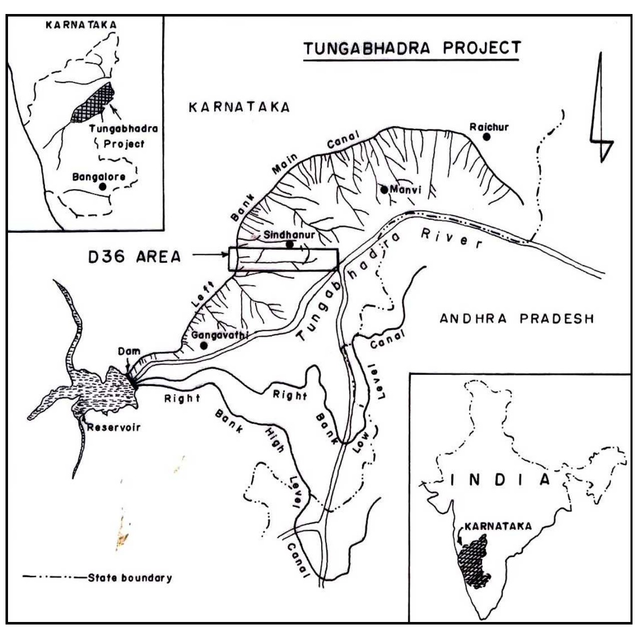


**Fig: 1. Location Map of Tungabhadra Irrigation Project**

The study was initiated during *kharif* (i.e. from August to December) 1998 and continued up to *rabi/summer* (i.e. from January to May) 2005-06. Water table depths were recorded on fixed grid points (B1 to B12) in each crop season after the harvest of the crop. The average water table data of all the 12 grid points were used to evaluate the effectiveness of the drainage system. To assess the amount of salts removed from the study area, drain discharges were measured manually with the help of measuring cans once in 15 days in each junction box and the total drain discharge was calculated. In total there are 21 junction boxes for the three drains. The electrical conductivity (EC) of the drainage water was measured with an EC meter for each sample collected from the junction box and the average data were used for the calculation of the salt balance.

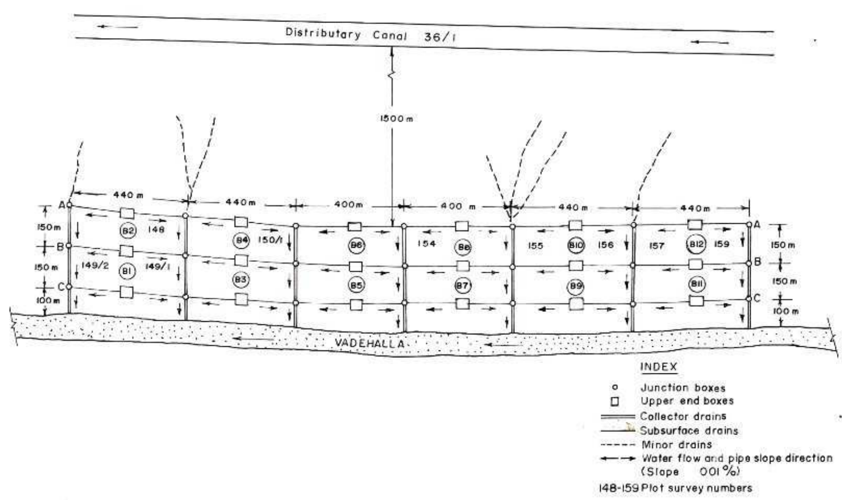


**Fig: 2. Field Layout of Sub Surface Drainage System**

Changes in soil salinity were evaluated by collecting soil samples at 0-30 cm depth on fixed grid points (B1 to B12). Four representative soil samples were drawn around each grid point within an area of 100 $m^2$ and mixed thoroughly to have one composite sample. The EC of the soil was determined in a soil water extract (1:2.5). The average soil salinity data of all the 12 grid points were used for interpretation. Crop performance was studied by conducting crop cutting tests (2 m x 2 m) at all the 12 fixed grid points where the soil samples were drawn and the average yield data of all the 12 observations were used for interpretation. Cropping intensity was worked out by collecting the data from the farmers during 1998-99 to 2005-06. The amount of nitrogen losses through drainage system were also studied in the pilot study area.

Salt balance of the study area was worked out by considering the amount of salts added through irrigation and fertilizer and the salts removed through the drainage system. Water requirement of the paddy crop in the command area was assessed as 1.1 m for a crop period of 120 to 135 days. The EC of the irrigation water was 0.25 dS/m. The amount of rainfall during kharif was 550 mm while it was only 50 mm during rabi. To calculate the salt balance, the standard factor of 0.6 from EC in dS/m to salt concentration in g/l or kg/$m^3$ was used. The recommended dose of fertilizer for paddy crop is 150 N, 75 $P_2O_5$ and 75 $K_2O$ per ha. The paddy crop was transplanted in August and January and harvested in December and May for kharif and rabi, respectively.

## 4. Results

### 4.1 Drain discharge

A higher drain discharge was recorded during the initial periods due to proper functioning of the drainage system and maximum drain discharge (370 $m^3$/day) was recorded during Sept 1998 and 1999 (Fig.3). This was coincided with post monsoon and paddy cropping season. However, there was no discharge during June and July months due to canal closure. Due to partial blockage of the system, lower drain discharge was recorded during the year 2000, 2001 and 2002. In the first four seasons, increase in salinity of drainage water was observed due to high initial top soil salinity, which leached through drainage system (Fig.4). Thereafter, drainage water salinity decreased with time as the soluble salt in the soil has been leached and soil had lower salinity (Table 3). As the total amount of drainage water increased, total amount of salts removed from the study area also increased. During *kharif*, 2004, drain discharges ranged from 2.66 to 7.47 $m^3$/day with an average discharge rate of 6.25 $m^3$/day (Table 1) (Fig.3) with the highest and lowest discharges recording during December and November respectively. During the 2004 cropping season, salinity of the drainage effluent ranged from 3.88 to 6.57 dS/m with an average salt concentration of 5.64 dS/m (Table 1). Drain water samples were also analyzed for possible nitrogen losses through sub-surface drainage system. In the pilot study area, it was estimated that nitrogen loss was to the extent of 0.105 kg/ha (for the drainage coefficient of 0.01mm). For the design drainage coefficient (DC) of 1.0 mm /day, the estimated nitrogen loss through sub-surface drainage system was about 10.5 kg/ha (Table 2). This loss is about 7 per cent of the nitrogen (150 kg N/ha) applied for paddy.

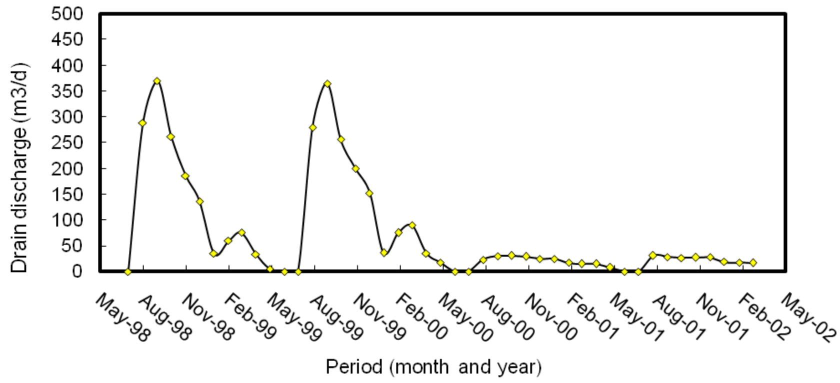

Fig.3 . Variation in drain discharge with time

**Table 1: Variation in mean drain discharge and drain water salinity with time**

| Year | Drain discharge ($m^3$/day) | | Drain water salinity (dS/m) | |
|---|---|---|---|---|
| | *Kharif* | *Rabi/summer* | *Kharif* | *Rabi/summer* |
| 1998 | 248 | 41.6 | 4.76 | 5.92 |
| 1999 | 250 | 50.6 | 4.50 | 7.90 |
| 2000 | 27.2 | 15.7 | 6.44 | 6.04 |
| 2001 | 28.1 | 14.9 | 5.22 | 5.37 |
| 2002 | 25.0 | - | 5.30 | - |
| 2003 | 7.23 | - | 5.19 | - |
| 2004 | 6.25 | 5.52 | 5.64 | 5.42 |
| 2005 | 4.15 | 3.72 | 4.12 | 4.43 |

(-) indicates no crop due to canal closure

During *rabi/summer*, 2004-05, drain discharge ranged from 4.63 to 6.36 $m^3$/day with an average discharge rate of 5.52 $m^3$/day (Table 1) (Fig 3). During the same period, salinity of the drainage effluent ranged from 4.17 to 7.48 dS/m with an average salt concentration of 5.42 dS/m (Fig. 4). For the design DC of 1.0 mm /day, the nitrogen loss during *rabi/summer* was about only 2.0 kg/ha (Table 2). During *kharif*, 2005 and *rabi/ summer*, 2005-06, average drain discharge rate was 4.15 and 3.72 $m^3$/day, respectively. During the same period, salinity of drainage effluent was 4.12 and 4.43 dS/m, respectively. The estimated nitrogen loss through sub-surface drainage system was about 4.6 and 4.7 per cent of the nitrogen applied for the paddy (ie., 150 kg N/ha) during *kharif*, 2005 and *rabi/summer* 2005-06, respectively (Table 2). Variation in nitrogen loss with time through subsurface drainage system is presented in figure 5.

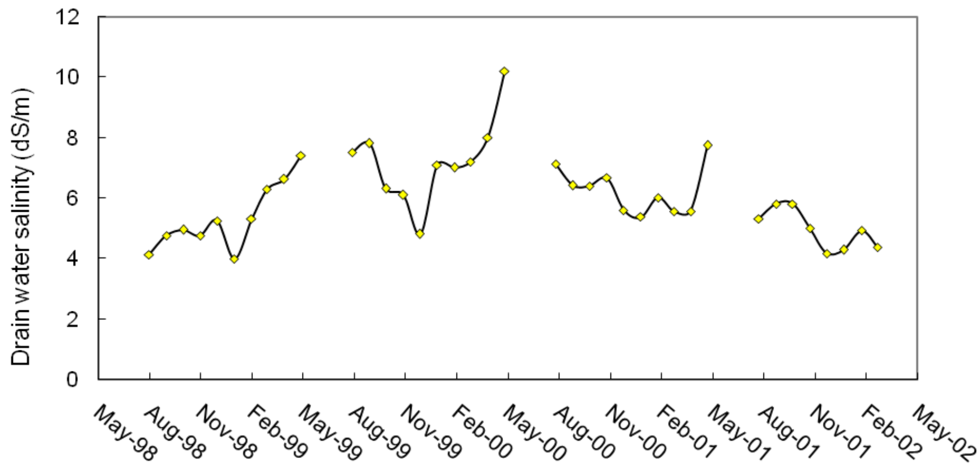


Fig. 4. Variation in drain water salinity with time

**Table 2: Nitrogen loss through subsurface drainage system**

| Drainage coefficient | Nitrogen loss (kg/ha) | | | |
|---|---|---|---|---|
| (mm/d) | K-2004 | R/S 2004-05 | K-2005 | R/S 2005-06 |
| 0.01 | 0.105 | 0.02 | 0.069 | 0.07 |
| 0.10 | 1.05 | 0.20 | 0.69 | 0.70 |
| 0.50 | 5.25 | 1.00 | 3.45 | 3.50 |
| 1.00 | 10.5 ( 7 ) | 2.00 (1.3) | 6.89 (4.6) | 7.00 (4.7) |

( ) indicates per cent loss of the RDN i.e., 150 kg/ha *K, Kharif R/S, Rabi/summer*

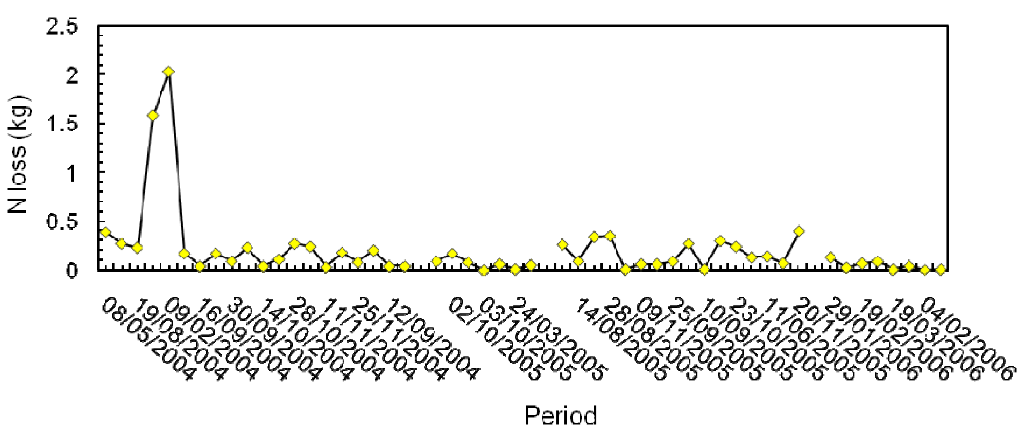


Fig. 5: Nitrogen loss through subsurface drainage system

## 4.2 Soil salinity

Sharp decrease in soil salinity in all the 12 grid points was observed during the first season and thereafter salinity remained constant with time. The mean soil salinity (0-30 cm deep) decreased from initial value of 8.4 dS/m to 2.6 dS/m during *kharif* 1998 and decreased further to 2.1 dS/m during *rabi* 98-99 (Table 3 and Fig.6). From *rabi* 1998-99 (after one year) onwards, salinity remained constant with time and maintained in the normal salinity range of 2 to 4 dS/m. Such salinity levels are considered normal for the cropping pattern that is followed in the command. During *kharif* 2004 and *rabi/summer* 2004-05, the average soil salinity (for 0-30 cm) was 3.1 dS/m and 3.8 dS/m, respectively. While, during *kharif*, 2005 and *rabi/summer* 2005-06, the average soil salinity (for 0-30 cm) was 1.6 dS/m and 3.6 dS/m, respectively (Table 3 & Fig.6).

**Table 3. Effect of sub-surface drainage system on average soil salinity, water table, crop yield and cropping intensity**

| Crop season | Parameters | | | |
|---|---|---|---|---|
| | Soil salinity (dS/m) | Water table (cm) | Crop yield (q/ha) | Cropping intensity (%) |
| Initial | 8.40 | - | 21.8 | 143 |
| K-1998 | 2.64 | 50 | 33.2 | |
| R/S 1998-99 | 2.15 | 67 | 66.7 | 177 |
| K-1999 | 2.43 | 62 | 59.5 | 186 |
| R/S 99-2000 | 3.63 | 85 | 60.9 | |
| K-2000 | 2.51 | 62 | 63.9 | 191 |
| R/S 2000-01 | 2.18 | 87 | 66.0 | |
| K-2001 | 2.63 | - | 70.0 | 191 |
| R/S 2001-02 | 3.30 | - | 75.0 | |
| K-2002 | 3.80 | - | 78.1 | 95 |
| K-2003 | 5.02 | - | 82.5 | 95 |
| K-2004 | 3.10 | - | 82.9 | 95 |
| R/S 2004-05 | 3.85 | - | 80.8 | 62 |
| K-2005 | 1.67 | - | 82.5 | 96 |
| R/S 2005-06 | 3.66 | - | 83.5 | 96 |
| Mean | 3.04 | - | 70.4 | 91.7 |

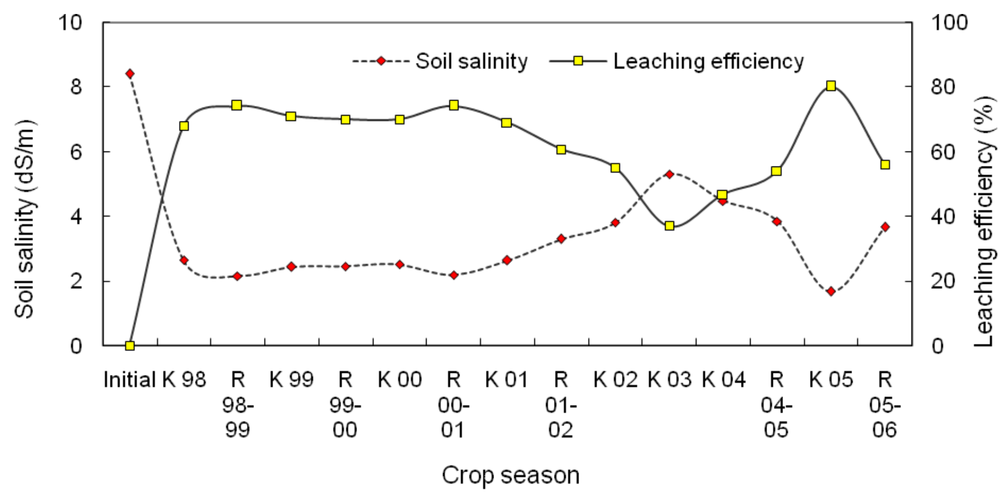

Fig.6: Effect of subsurface drain on soil salinity (0-30 cm)

Profile soil salinity (0- 90 cm) in the control was observed to be 8.5 ± 0.8, 7.9 ± 0.6 and 6.8 ± 0.6 dS/m for the 0-30, 30-60 and 60-90 cm depth respectively, during December 2000. While in the drained area, the soil salinity was observed to be 2.5 ± 0.4, 3.4 ± 0.5 and 3.5 ± 0.5 dS/m for the 0-30 (avg depth 15 cm), 30-60 (avg depth 45 cm) and 60-90 cm (avg depth 75 cm) depth, respectively (Fig.7). This indicated that the soluble salts in the soil rhizosphere were leached more effectively throughout the soil profile with drainage. Due to blockage of the drainage system, a marginal rise in profile salinity was observed during December 2001, April 2002 and December 2002. During *kharif*, 2004, the soil salinity was observed to be 4.5, 3.5 and 3.6 dS/m for the soil depth of 0-30 (avg depth 15 cm), 30-60 (avg depth 45 cm) and 60-90 cm (avg depth 75 cm) respectively (Fig.7).

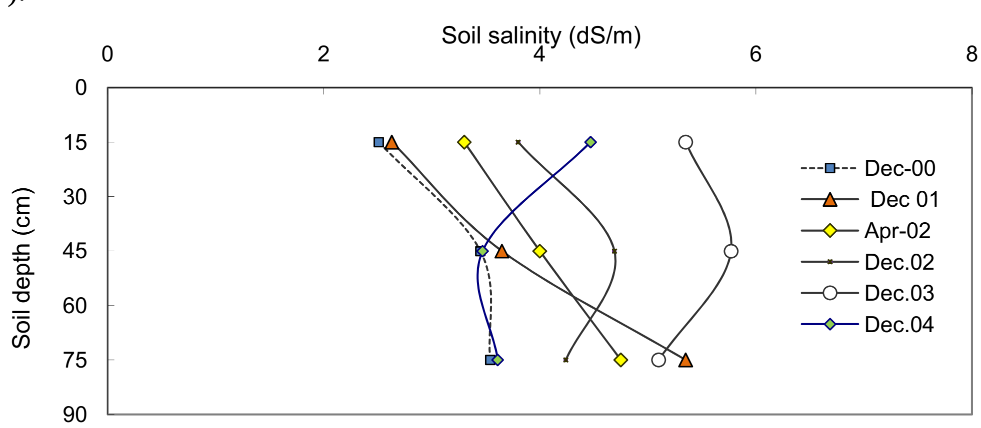

Fig.7: Variation in profile soil salinity with time

**Table: 4 .Temporal variation in quality and magnitude of drain discharge of Sub surface drainage system**

| Period | Drain discharge(m3/day) | Drain discharge(mm/day) | EC dw(ds/m) | Salt removal (tons) |
|---|---|---|---|---|
| Jul-98 | 0 | 0 | | |
| Aug-98 | 288 | 0.465 | 4.13 | 23.59 |
| Sep-98 | 370 | 0.597 | 4.75 | 33.74 |
| Oct-98 | 262 | 0.423 | 4.95 | 25.73 |
| Nov-98 | 186 | 0.300 | 4.75 | 16.96 |
| Dec-98 | 136 | 0.219 | 5.25 | 14.16 |
| Jan-99 | 34.9 | 0.056 | 3.98 | 2.75 |
| Feb-99 | 59.3 | 0.096 | 5.3 | 5.63 |
| Mar-99 | 75.2 | 0.121 | 6.29 | 9.39 |
| Apr-99 | 33.6 | 0.054 | 6.62 | 4.27 |
| May-99 | 5.3 | 0.009 | 7.4 | 0.77 |
| Jun-99 | 0 | 0.000 | - | - |
| Jul-99 | 0 | 0.000 | - | - |
| Aug-99 | 280 | 0.452 | 7.5 | 41.70 |
| Sep-99 | 365 | 0.589 | 7.8 | 54.70 |
| Oct-99 | 256 | 0.413 | 6.3 | 32.00 |
| Nov-99 | 200 | 0.323 | 6.1 | 23.4 |
| Dec-99 | 152 | 0.245 | 4.8 | 14.5 |
| Jan-00 | 36 | 0.058 | 7.1 | 5.1 |
| Feb-00 | 75 | 0.121 | 7 | 9.4 |
| Mar-00 | 90 | 0.145 | 7.2 | 12.9 |
| Apr-00 | 35 | 0.056 | 8 | 5.4 |
| May-00 | 17 | 0.027 | 10.2 | 3.4 |
| Jun-00 | 0 | 0.000 | - | - |
| Jul-00 | 0 | 0.000 | - | - |
| Aug-00 | 23.0 | 0.017 | 7.13 | 3.25 |
| Sep-00 | 29.4 | 0.047 | 6.41 | 3.62 |
| Oct-00 | 30.3 | 0.049 | 6.4 | 3.85 |
| Nov-00 | 28.8 | 0.046 | 6.66 | 3.68 |
| Dec-00 | 24.6 | 0.040 | 5.6 | 2.73 |
| Jan-01 | 24.7 | 0.040 | 5.37 | 2.63 |
| Feb-01 | 16.7 | 0.027 | 6.01 | 1.8 |
| Mar-01 | 14.5 | 0.023 | 5.56 | 1.56 |
| Apr-01 | 14.6 | 0.024 | 5.56 | 1.56 |
| May-01 | 7.8 | 0.013 | 7.74 | 1.22 |
| Jun-01 | 0 | 0.000 | - | - |
| Jul-01 | 0 | 0.000 | - | - |
| Aug-01 | 30.8 | 0.050 | 5.32 | 3.25 |
| Sep-01 | 28.4 | 0.046 | 5.81 | 3.17 |
| Oct-01 | 26.7 | 0.043 | 5.81 | 3.08 |
| Nov-01 | 27 | 0.044 | 5 | 2.59 |
| Dec-01 | 27.5 | 0.044 | 4.17 | 2.28 |
| Jan-02 | 18.55 | 0.030 | 4.28 | 1.58 |
| Feb-02 | 17.4 | 0.028 | 4.92 | 1.53 |
| Mar-02 | 16.4 | 0.026 | 4.36 | 1.42 |
| **Mean** | **74.74** | **0.12** | **5.99** | **Total 384.29** |

**4.3 Water table**

Water table depth was recorded in each crop season after the harvest of the crop (Table 3). Depth to water table decreased over a period of time in all the 12 observation grid points. The mean water table depth was lowered from 50 cm to 67 cm during the first year itself. In the second and third year, depth to water table is further decreased considerably from 67 cm to 85 cm indicating effective functioning of the sub surface drainage.

## 4.4 Crop yield

Crop performance under Sub surface drainage system was studied by conducting crop cutting at all the 12 observation points. The average yield in the study area increased sharply (Table 3) from its initial value of 21.8 q/ha to 33.2 q/ha in the first season (*kharif*, 1998) itself. It improved further to 66.7 q/ha in the second season (*rabi / summer* 1998-99). Higher paddy yields (> 75 q/ha) were also recorded during *kharif*, 2002 (78 q/ha) and 2003 (82 q/ha). Paddy yields recorded during *kharif*, 2005 and *rabi/summer*, 2005-06 were 82.5 and 83.5 q/ha, respectively (Table 3 & Fig. 8). The improvement in paddy yield could be ascribed to decrease in soil salinity, introduction of improved management practices, switchover to high yielding varieties and increased use of nutrients upon reclamation of soils.

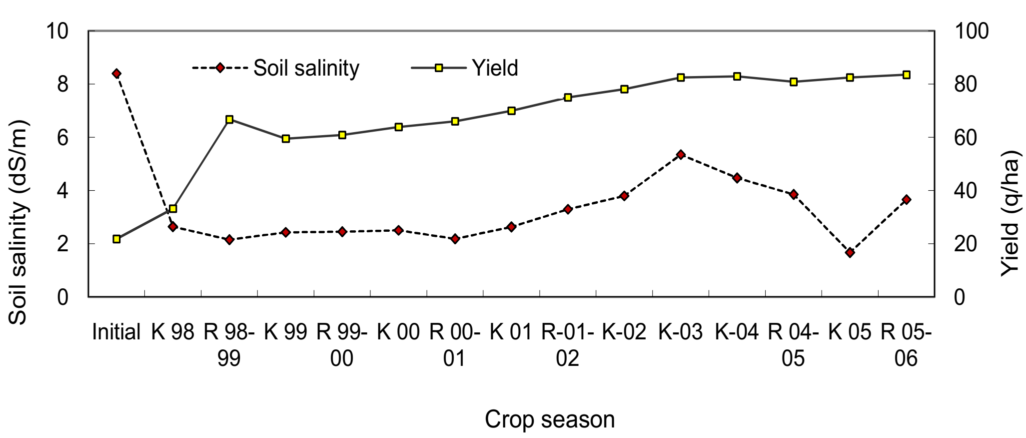


Fig.8 Influence of sub-surface drainage system on soil salinity and crop yield

### 4.5 Cropping intensity

The cropping intensity of the study area was worked out by collecting the data from the farmers during 1998-99 to *kharif*, 2005. Besides increase in the yield of crop, a significant increase in the cropping intensity of the study area was observed. The average cropping intensity, which was 143 per cent before the installation of the drainage system improved to 177 per cent during 1998-99 and further improved to 191 per cent during 2000-01 and 2001-02 (Table 3). This improvement in the cropping intensity could be due to reclamation of the salt-affected soils and the awareness created about the importance of the drainage system. Due to the non-availability of canal water, *rabi/summer*, 2002-03 and 2003-04 crops was not taken-up in the study area. The cropping intensity during *kharif* 2002 *kharif* 2003 *kharif*, 2004 and *kharif* 2005 was 95 percent. Due to uneven distribution and shortage of irrigation water, the cropping intensity (for one season) was reduced to 64 per cent during *rabi/summer* 2004-05.

### 4.6 Salt balance studies

Due to effective functioning of the drainage system in the first and second year (August1998 to March 2002), the amount of salts (384.29 Mg) (Table 4) removed from the drainage system was more than that of salt input (228.4 Mg) and thus resulted in considerable decrease in the root zone salinity. In the third and fourth year (August 2000 to April 2002), the reversing trend was noticed due to the blockage of the drainage system and the amount of salts added was more than that of removal. The cumulative salts added through irrigation and fertilizer application during the period was about 390.6 tonnes while, the salts removed through drainage system was about 368.4 Mg (Fig.9). Due to this a marginal build up in profile soil salinity was observed during Dec. 2001, April 2002 and December 2002.

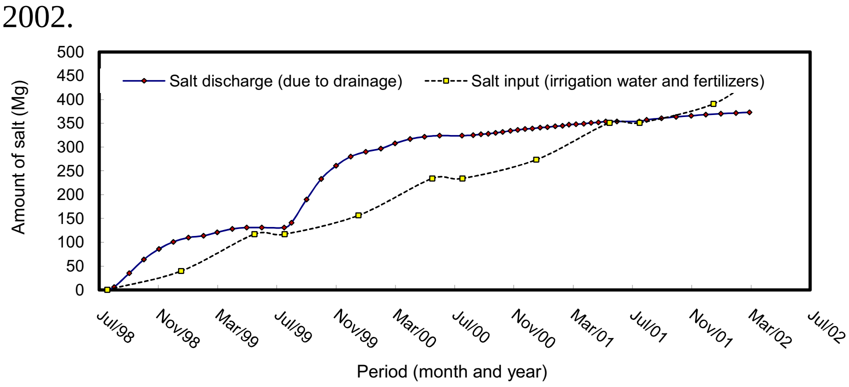

Fig.9. Cumulative salt input and discharge showing leaching and storage of salts

### 4.7 Economic analysis

The initial investment cost of the sub drainage system was worked out to be Rs.13150/- per ha (Table 5). By considering the interest on investment and the annual maintenance costs, the annual cost of the system could be Rs. 1673/-per hectare. By accounting the additional yields produced due to improvement in soil condition and the additional income generated (Rs. 200/quintal) due to higher yields, entire amount spent for land reclamation through interceptor drainage system can be reimbursed in about one and half year, which indicates the system is quite remunerative and cost effective.

**Table 5 : Economic analysis of sub surface drainage system**

| Sl.No | Particulars | |
|---|---|---|
| 1 | Location | D-36/1, Sindhanur |
| 2 | Area covered (ha) | 62.00 |
| 3 | Year of installation | 1998 |
| 4 | Drain spacing (m) | 150 |
| 5 | Cost per hectare (Rs) | 13150.00 |
| 6 | Life period (Years) | 10 |
| 7 | Annual system cost (Rs/ha) | 1315.00 |
| 8 | Interest on investment @ 12 % (Rs/ha) | 158.00 |
| 9 | Repairs and maintenance (Rs/ha) | 200.00 |
| 10 | Total annual cost of the system (Rs/ha) | 1673.00 |
| 11 | Pay back year of the system due to additional yield Rs.200/q | Kharif-1999 |
| 12 | Pay back duration (Years) | 1 ½ |

## 5. Summary and Conclusions

1. Reduction in soil salinity, lowering of water table, improvement in crop yield and cropping intensity indicated the necessity of subsurface drainage system to reclaim the salt affected soils. Hence promotion of drainage system on larger scale can be taken up to increase the agriculture productivity.

2. Nitrogen loss through SSD was estimated as 7, 1.9, 6.89 and 7.00 per cent of the RDN (150 kg/ha) during Kharif, 2004, Rabi/Summer, 2004-05, Kharif, 2005 and Rabi/ Summer, 2005-06, respectively.
3. The effective functioning of the drainage system plays an important role in reducing the salt concentration in the soil profile and lowering of water table. Hence, creating awareness among the farming community/ department personnel about the proper maintenance of drainage system through extension activities is required
4. Considering the magnitude of water applied to paddy and seepage from higher reaches/ canal, the drains installed at 150 m spacing acted both as sub-surface drains for reclamation of saline- waterlogged soils and interceptor drain for arresting canal seepage to avoid further waterlogging and soil salinity problem in low lying areas.
5. The economic analysis indicated that the amount spent for land reclamation can be reimbursed in 1 ½ - 2 years. The SSD system is quite remunerative and cost effective. Hence, creating awareness among the farming community/ department personnel about the direct and indirect benefits of the drainage system is needed.

## 6. References

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