SUCCESS STORY UNDER RKVY

1. **Title :** Increasing Agricultural Productivity by Amelioration of Problematic Soils
2. **Category-agriculture, horticulture, animal husbandry etc.:** Agriculture –Natural Resource Management
3. **Challenge:**

In Karnataka, out of the total 1,28,562 ha of land being irrigated, 12,692 ha land is affected by water logging, salinity or alkalinity which accounts to 9.9 per cent of the total irrigated area.

Excess soil salinity causes poor crop stand, uneven and stunted growth and poor yields. The extent of damage depends on the level of salinity. The primary effect of excess salinity is that it renders less water available to plants though water is present in the root zone. This is because the osmotic potential of the soil solution, which receives more negative with increase in salt content. Besides excessive concentration and absorption of individual ions may prove toxic to the plants and or may retard the absorption of other essential nutrients.

The sub-surface drainage installation involves high initial cost per hectare of area as compared to other options of reclamation but, it is important to adopt a optimum design criteria to keep the cost at minimum. The out let drain depth can be selected considering outlet conditions and crops to be grown. Thus in this view the area in Bhadra command and Cauvery command was surveyed and analysis was done to identify the area under saline, sodic or waterlogged condition. Soil samples were collected and analyzed for pH and total soluble salts. Based on the analytical results water logged and salt affected patch at Tyavangi(136 acres), ChannagiriTq., and V.C. Farm, Mandya (43.75 acres)was selected for implementation of the project.

Salt affected area at V.C. farm,Mandyabeforeinstallation of SSD

Water logged area at Tyavanagi village before installation of SSD

Interaction with farmers at ChikkarasinakerevillageofMandya district

Interaction with farmers at Tyavanagi village of Davanagere district

4. **Initiative :**

Topographic survey of the study area was completed in August - 2013 and a detailed report (DPR) containing contour map, SSD (sub- surface drainage) plan etc., was finalized for selected sites of both Bhadra and Cauvery command.

Based on physical appearance of the field and analytical results of the soil analysis, it was decided to implement the sub-surface drainage work. Immediately after harvest of paddy crop, the subsurface drainage work was initiated by laying perforated PVC pipes covered with white polyester geotextile in the lateral lines at 90 cm depth. Each of these laterals were maintained at a spacing of 40 m interval in all the area's except at severe sodicity,laterals were laid out at 30 m interval. All these laterals were connected to main drains or collectors which were directed to nala. At the junction of laterals joining the main drains, chambers were constructed with options for ladders to monitor the silting up of the drains.

In selected area, soil samples collected at 3 different depths from 25 soil profiles were analyzed for pH, EC and ESP in the laboratory. Meanwhile, surface soil samples from 72 individual survey nos. of all farmers were analyzed for pH, EC and ESP.

In Bhadra command study area 25 piezometers were installed covering low and mid- land situation in order to monitor fluctuation in water table. Water samples were collected at monthly interval from each of these piezometers and were analyzed for pH, EC, CO_3, HCO_3, SO_4, Cl, Ca, Mg, K, Na, SAR and were classified into different classes to verify the suitability of water for irrigation.

Similarly, in Cauvery command at VC farm, Mandya, 43.75 acres of waterlogged and salt affected land was identified for installation of subsurface drains covering B (25 acre)and D (18.75 acre) blocks of the farm.

Demonstration of technology to improve rice productivity in Bhadra command study area during *kharif*-2012

Technological interventions:

a) Salt tolerant varieties-GGV-05-01, CSR-22
b) Gypsum application.
c) Higher population per unit area.

Compared with farmer's practice using farmer's variety (AnkurSona and JGL-1798).

Field demonstrations during summer 2013:

Eight field demonstrations entitled "Technology demonstration to improve rice productivity in salt affected soils of Bhadra command"were taken at project site.

Technological interventions:

a) Salt tolerant varieties GGV-05-01, CSR-22,BPT-5204,GangavathiSona, IR-8, Vikas.
b) Gypsum application and sulphur
c) Higher population per unit area.

Compared with farmer's practice using farmer's variety (AnkurSona)

Collection of leachate from main drains: Immediately after installation of subsurface drains, leachate samples were collected from each outlets (10), (Weekly interval in the beginning and 15 days interval from February onwards) from 10-1-2014 including the cropping period, and also recorded velocity of leachate flow and samples were analyzed for different ions to know the amount of salts leached at different days.

A view of survey before installation of sub surface drainage

Collection of soil samples at farmers field

A general view of survey work and installation of sub surface drainage pipes at Tyavanagi village

5. Key results/ insight/ interesting fact :

At Bhadra command area soils were medium black, clay loam to clay textured with very poor drainage ability. Soils were characterized into waterlogged, saline and saline-sodic soils. Soil pH ranged from 8.1 to 9.4, EC (1:2.5) 0.33 to 1.46 dSm^{-1}, ESP 1.3 to 56.7.In 17 farmer's field soils were sodic and based on the gypsum requirement (70+70 tons) gypsum was distributed twice to these 17 farmers covering 51 acres.

Piezometer study indicated that the depth of water table ranged from 4 cm to >150 cm. EC ranged from 0.80to 6.87dSm^{-1}, HCO_3 and Cl of Na and Cawere the predominant salts. Water quality for irrigation purposes falls under C_3S_1 to C_4S_2 as per USSL system.

Among the salt tolerant variety evaluation (2012), CSR–22 a salt tolerant variety from CSSRI, Karnal performed better (49.5 q/ha) than the locally popular varieties among the farmers *viz.* AnkurSona (28.7 q/ha) and JGL – 1798 (38.4 q/ha).Significant variation in rice productivity was recorded during 2013 among different varieties and also due to amendments. Highest productivity of 23.5 g/hill was recorded byGangavathiSona with gypsum application and lowest value was recorded by BPT-5204 at control.Gypsum proved to be a better amendment than sulphur.

At Cavery command 8 species of grasses/ medicinal plants (Brecceria, Seteria, Lemon grass, Vetiver, Citronella, Palmarosa, Thyme and Brahmi) were evaluated on calcareous soils, Brahmi rejuvenated well (80-85%) compared to Thyme. Among the grass species Brecceria and Seteriasps.rejuvenated well (95.00 and 96.00% respectively), indicating the Brecceria, Seteriasps. andBrahmi are the best suited species for calcareous soils.

A view of leachate sample collection from outlets and distribution of gypsum to beneficiary farmers at Tyavangi village

6. Impact :

At Bhadra command paddy yields were increased in 67 farmer's field (136 acre) after subsurface drainage installation to an extent of 22.99 per cent, compared to paddy yield before subsurface drains installation (average - 21.42 q/acre). Second crop also increased to an extent of 25.13 per cent, whereas, in 13 sodic soil farmers field, yield increased to an extent of38.28 per cent by addition of gypsum with an average yield of 28.93 q/acre.If the extra grain obtained is calculated for its market rates (Rs. 1500/q) nearly 10.50 lakhs extra profit is obtained from this technology in a single season. Similarly, if gypsum is applied where ever still sodicity problems exist and grown crops, the amount incurred on SSD installation (Rs. 42. 00 Lakhs) can be back within a span of two years as farmers are taking two crops a year.

The leachate was quantified and analyzed for cations and anions. Totally 1.26 crorelitres of water was leached out and 19.65 tons of salts were removed from 136 acre area. Among the cations, Na (1.61 t) was the dominant cation followed by Ca (1.47t) and HCO_3 (9.13 t) was dominant followed by chlorides (4.00 t) among anions.

After seeing the success in improving problematic soils by installation of SSD at Bhadra command area, two farmers *viz*., **Thippeshappa of Doddaghatta village and Basappa of Navilehal village of Davangere district** have adopted SSD and soil test gypsum application technology on their ownto overcome salinity-sodicity problems by seeking advice from the project leader in their6 and 2.5 acres of land by spending 3.5 and 1.75 lakh rupees, respectively.

At Cauvery command, after SSD installation,paddy yields have been increased from 12.74 q $ha^{-1}$to 13.53 q ha^{-1} per acre in 2013-14 to 2014-15 and further to 31.65 qha^{-1}per acre in 2016-17 in B-block.

In the year 2014, sugarcane was planted in an area of 1.5 acre at D-block from which 74.5 tons of sugarcane was harvested, where no crop was grown earlier due to salinity- sodicity problem.

The soil properties after SSD installation indicated that the pH, EC and ESP has reduced from 8.99 to 8.83, 1.20 to 0.99 dSm^{-1} and 16.31 to 13.16 % respectively, indicating the improvement in soil properties through SSD installation.

General view of standing crop after installation of sub surface drainage at Cauvery command

General view of standing crop after installation of sub surface drainage at Bhadra command

A general view of crop cutting and threshing after installation of sub surface drainage

7. Lessons Learnt :

The demonstrations clearly indicated that this type works can be taken in large scale only with cooperation all the beneficiary farmer's. Even one or two farmer's don't cooperate, it will be difficult to make it success in reclamation.

Similarly, in calcareous soils just SSD installation and sulphur application will not help in complete reclamation. One has to go for identifying the tree/medicinal/ grass species for these soils till the soil is improved, as in the present study at ZARS, Mandya.

Large scale demand is there for SSD installation from the farmer's specially at Bhadra command, that needs to be taken care by the CADA, so that productivity of these problematic lands can improved to a greater extent.

8. Supporting Quotes and Images :

- SSD installation is good for improving waterlogged and salt affected soils
- Soil test based gypsum application along with SSD installationimprovesphysico-chemical properties of sodicsoils,thereby improve the crop productivity
- Forest species (Jamun and Simaruba), medicinal plant (Brahmi) and grass species (*Brecceria and Seteriasps*) were found to be best suited for calcareous soils

A view of forest species, medicinal and aromatic plants planted at Cauvery command and crop cutting at Bhadra Command areacrop cutting and threshing after installation of sub surface drainage

9. **Additional information:**DVD on success story of reclamation of problematic soils through subsurface drainage installation on 136 acres at Tyavangi village of Davanagere district was prepared and distributed to more than 300 needy farmers so far.

10. Checklist :

No.	Question to consider	Yes	No
1	Is the story interesting to the target audience of the project / activity report ?	Yes	--
2	Does the story explain what new insights the project brings ? What is the main lesson learned from this story ? Does the story describe a Key insight on what works and what doesn't and something that future project could build on	Yes	--
3	Does the story describe the outcomes the project produced and the people who are benefitting ?what changes-in skills, knowledge, attitude, practice, or policy-has the project brought, and who is benefitting from these changes ?	Yes	--
4	Does the story make a compelling point that people will remember ? Does the story show how the project makes a difference to improving livelihoods and lessening poverty ?	Yes	--
5	Does the story provide an interesting fact that people will remember ? For example, how much yields increased, how many hectares of land could become more productive from this innovation or technology ?	Yes	--
6	Does the story explain what kind of impact this innovation or technology could have if scaled up ?	Yes	--
7	Does the story show which partners contributed and how ?	Yes	--
8	Does the story include quotes from Stackeholders or beneficiaries ?	Yes	--
9	Have I provided links to other media (journal articles, website news, newsletter, blogs, annual reports of other Programme/ project) that also feature this story ?	--	No
10	Have I provided the contact details of people who can provide more information ?	Yes	--