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FOREWORD

In India, about 60% of the cultivated area is rainfed but contributes only about 40% to the national food basket. The rainfed/dryland agro–ecosystem in India is characterized by erratic distribution of rainfall and occurrence of droughts is a common feature. Under such situations, *in situ* rainwater conservation plays a vital role in maintaining/increasing crop productivity. The rainwater conservation measures are part of agronomic practices in the rainfed production system which are being adopted to suit a particular climate, soil, crop and cropping system by the resource poor farmers. The production of most rainfed crops averages between 400 and 900 kg ha⁻¹ and can be enhanced significantly with appropriate resource conservation and management techniques.

In black soils of the States of Karnataka, Maharashtra, Andhra Pradesh and Tamil Nadu with rainfall less than 750 mm per annum, rainwater can be effectively conserved *in situ* with formation of compartmental bunds. Compartmental bunding helps in conserving *in situ* rainwater, recharges the soil profile early and results in early sowing of the crops with onset of South–West (*kharif* season) and North–East (*rabi* season) monsoon in both red and black soils. The effect of *in situ* rainwater conservation through compartmental bunding is higher, especially during drought years with enhanced crop yields compared to normal and above normal rainfall situations.

In this brochure, salient features of compartmental bunding for *in situ* rainwater conservation have been presented. I sincerely hope that the technology would immensely the farmers and user agencies.

(V. N. Sharda)
Director
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Compartmental bunding for *in situ* rainwater conservation in medium to deep black soils

Introduction

Water is the major limiting factor for crop production in the black soils region of semi-arid tropics of India due to low rainfall (400–650 mm) and its erratic distribution with unpredictable occurrences of dry spells/droughts of different intensities from year to year and within the individual crop growing season resulting in lower productivity. Efficient utilization of rainwater is of great concern for the improvement and sustainability of agriculture in the dryland agro-ecosystem. In addition, the presence of black soils with high clay content and low infiltration rate results in 10 to 30% runoff with loss of fertile top soil.

The farmers in the dryland black soil regions of South India should aim to harvest every drop of rainwater *in situ* and increase the water use efficiency for higher crop productivity. The scarce rainwater in these regions can be efficiently harvested *in situ* through agronomic measures that include tillage operations, *in situ* moisture conservation practices i.e. mulching, vegetative barriers, residue management and cropping systems with better advantage of reducing surface runoff (water, soil and nutrient losses). This in turn results in increased soil water and nutrient content in the soil profile leading to better crop growth and higher productivity.

Compartmental bunding conserves the rainwater *in situ*, recharges soil profile uniformly, reduces runoff, soil and nutrient losses and increases crop yields on a sustainable basis. This technology is simple and low cost and can be

adopted by the farmers easily in the medium to deep black soils in the region.

Technology Details

Compartments of different sizes are formed with the bund former (Photo 1) depending upon soil type and slope to conserve rainwater *in situ*.



Photo 1. Compartmental bund former

Specifications

- For a bund of cross section 0.06 m^2 the specifications would be, bottom width 0.5 m, top width 0.1 m, height 0.2 m and side slope 1:1.

- The sizes of the compartments with land slope are:

Land slope	Compartment size
>2%	5 m × 5 m
<2%	10 m × 10 m

Technology Implementation

When to form compartmental bunds?

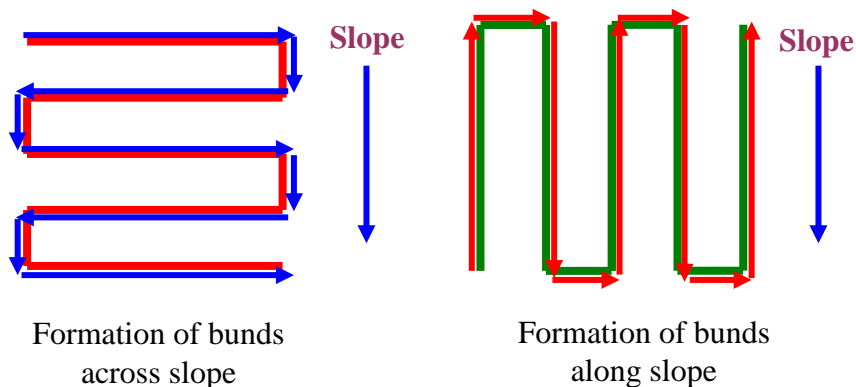
Compartmental bunds in medium to deep black soils are formed after preliminary tillage operations are completed during monsoon i.e. between June to July, to conserve rainwater *in situ*.

Field lay out

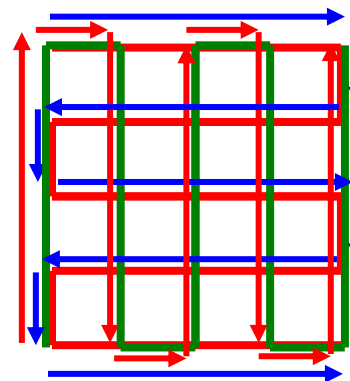
Step 1:

Complete all the primary tillage operations i.e. ploughing followed by harrowing or harrowing alone and make the field ready for compartmental bunding lay out.

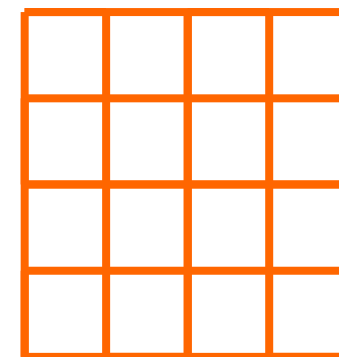
Step 2: With the help of bund former, form compartmental bunds all along the slope at a required spacing, depending upon the field slope.



Step 3: Similarly, compartmental bunds must also be formed across the slope at a required distance so that the entire field is laid out with compartments of required size (Photos 2 and 3).



Formation of compartmental bunds across and along slope



Final lay out of field with compartments

Step 4: With the help of the spade, shaping of the bunds may be done at the corners of the compartments after laying out the field.



Photo 2. Lay out of Compartmental bunds



Photo 3. Compartmental bunds in the field

Cost

- One pair of bullock and one bund former are required for a day to complete compartmental bunding of 10 m × 10 m in one hectare and they would cost around Rs. 550 per ha for the lands having <2% slope.
- If the land slope is higher, than 2% additional cost of Rs. 200 i.e. Rs. 750/- per hectare is required as the size of the compartmental bunds will be 5 m × 5 m. The cost of lay out of compartmental bunding is as follows.

Particulars of field operations	Cost (Rs.)	Total cost (Rs.)
One pairs of bullock with one bund former for a day to complete one ha	250	250
Three male labourers for final shaping/ corrections of compartmental bunds at corners after lay out of field with bund former	100	300
Cost of layout of one hectare land with 10 m × 10 m compartmental bunds	550	

Bund Former Availability

Bund formers are available at the office of Joint Director of Agriculture, Agro-industries, Implement factory of Government and private agencies. The cost of tractor drawn and bullock drawn bund formers are Rs. 8500/- and Rs. 3500/-, respectively.

Benefits of Compartmental bunding

- Terrace level rainwater conservation measures such as contour bunding and graded bunding conserve the rainwater within the bunded area. However, rainwater conserved is not uniformly spread due to undulations and land slope. Hence, wetting of soil profile is not uniform with terrace level moisture conservation practices. Conservation of rainwater through compartmental bunding (*in situ* moisture conservation practices) conserves the excess rainwater with higher recharge of the soil profile uniformly within the bunded area during the rainy season and increases the availability of soil water at different stages of crop growth in the medium to deep Vertisols during postrainy season.
- Compartmental bunding is more beneficial in medium to deep black soils with high clay content (>45 %) and low infiltration rate (0.8 to 1.2 mm h⁻¹).
- Adoption of compartmental bunding reduces runoff, soil and nutrient losses.
- On account of higher soil water content in the soil profile of fields with compartmental bunds, early sowing can be done, resulting in better plant growth and increased crop yields, especially during severe to mild drought years, as compared to normal and above normal rainfall situations.
- Increase in crop yields of *rabi* sorghum, bengalgram, sunflower and safflower varies from 5 to 30% in the farmers fields' laid out with compartmental bunding in the black soil region, especially in the areas receiving less than 650 mm rainfall per annum depending upon the antecedent and crop season rainfall.

- Compartmental bunding is a low cost *in situ* moisture conservation practice that can be easily laid out with the help of a bund former in the farmers' fields.

Yield Advantage

- At Central Soil and Water Conservation Research and Training Institute, Research Centre, Bellary (Karnataka) in deep black soils (Vertisols), laying out of fields with compartmental bunds increased the *rabi* sorghum yields by 26% during 1986–90 and 17% during 2000–03 (Table 1).
- The magnitude of increase in grain yield with compartmental bunding was higher (28%) during moderate drought year as compared to only 16% during normal year.
- At Bellary, the water use efficiency (WUE) in *rabi* sorghum was higher (9.86 kg ha⁻¹ mm⁻¹) during moderate drought year as compared to above normal rainfall year (8.20 kg ha⁻¹ mm⁻¹) and severe drought year (6.71 kg ha⁻¹ mm⁻¹). These results indicate that every unit of water was more efficiently utilized to produce grain under ideal soil water availability condition in the soil profile as compared to above and below normal water availability in the profile.
- At Chinnatekur watershed in Kurnool district of Andhra Pradesh, *rabi* sorghum yields increased by 21% and groundnut yields increased by 20% with compartmental bunding over control (Table 1).

Table 1. Impact of compartmental bunding on crop yields

Treatments	Yield (q ha ⁻¹)		
	Control	Compartmental bunding	% increase
Bellary			
Sorghum (1986–90)	12.10	15.18	26
Sorghum (2000–03)	18.15	21.22	17
Kurnool (Chinnatekur watershed)			
Groundnut	6.01	7.18	20
Sorghum	9.31	11.22	21

Economics

Demonstrations of compartmental bunding in 30 farmers' fields during 2001 to 2003 in 10 villages of Bellary district in Karnataka State and 15 farmers' fields in 5 villages of Kurnool district in Andhra Pradesh in *rabi* sorghum indicated higher grain yield and net benefit/profit of Rs. 1996 and 2083 per ha, respectively over control (Table 2).

Table 2. Impact of compartmental bunding in Bellary and Kurnool districts (Average of three years)

State/District	Treatment	Sorghum grain yield (q ha ⁻¹)	Net returns (Rs. ha ⁻¹)
Karnataka/ Bellary	Control	11.48	5204
	Compartmental bunding	13.00 (13)	7200
Andhra Pradesh/ Kurnool	Control	11.48	5213
	Compartmental bunding	13.03 (13)	7296

Figures in parenthesis indicate % increase

For computation of economics, March 2008 rates were considered

Scope for Application

The technology of compartmental bunding is applicable in the Vertisols (medium to deep black soils) region in Akola and Sholapur districts of Maharashtra, Bijapur, Bagalkot, Gadag, Koppal, Haveri, Dharwad, Chitradurga and Bellary districts of Karnataka, Kurnool, Anantapur, Kadapa and Mehabubnagar districts of Andhra Pradesh and Dindigul district of Tamil Nadu, which fall in the semi-arid tropical region of India with less than 750 mm annual rainfall, and can be adopted by all the farmers in the region for *in situ* conservation of rainwater and fertile top soil.

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COMPARTMENTAL BUNDING FOR *IN SITU*
RAINWATER CONSERVATION IN MEDIUM TO
DEEP BLACK SOILS



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