STUDY ON THE EFFECT OF BEDDING METHOD OF LAND DEVELOPMENT ON MOISTURE CONSERVATION

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Affectionately Dedicated

to my Beloved Parents

UNIVERSITY OF AGRICULTURAL SCIENCES

Department of Agricultural Engineering
Bangalore.

CERTIFICATE

This is to certify that the thesis entitled "Study in the effect of bedding method of land development on moisture conservation", submitted by **Mr. S. Prabhakar** in partial fulfilment of requirements for the degree of **Master of Science** (Agriculture) in soil and water conservation engineering to the University of Agricultural Sciences, Bangalore, is a record of the research work carried out by him under my guidance and supervision and that no part of this thesis has been submitted for the award of any other degree, diploma, associateship, fellowship or other similar titles.

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INTRODUCTION

I. INTRODUCTION

Agriculture sector has played a dominant role in economic development of India. About 40 per cent net national product and 35 per cent export earnings are contributed by this sector, besides providing employment to 60 per cent population. Since independence, huge sum of public funds has been incurred in creation of irrigation potentials resulting in 30 per cent irrigated area. Due to various constraints of physiography, economy and availability of water resources, the ultimate irrigated area may not exceed beyond 50 per cent of the aerable land. Further, it has been recognized that the impact of green revolution was limited to irrigated crops like wheat and paddy. It is therefore, imperative to harness production potentials of dryland agriculture which contributes 42 per cent of the total foodgrain production and 85 per cent pulses and oilseeds. Agriculture production from dryland areas depends mainly on the amount of rainfall received.

Water is one of the natural resource factor for sustenance of life and economic well being. It is a renewable but limited resource made available through a complex hydrological cycle, comprising of a set of related ecological processes, by which water is made available to an ecosystem through precipitation, surface run-off, replenishing of ground water and is finally returned to the atmosphere through evaporation and transpiration.

India, with geographical area of 329 million hectares has a water potential of about 400 million hectare meters from precipitation, about 18 million hectare meters from surface water and 42 million hectare meters from ground water, but only about 50 per cent of this can be put to beneficial use. Rainfall received over the country during monsoon is nearly 75 per cent of the mean annual, while during pre and postmonsoon seasons, the country receives about 10 to 11 per cent of the mean annual. During January and February receives just about 3.5 per cent of the mean annual rainfall. Water is the single most important renewable natural resource which, through its interaction with the dryland agriculture would contribute to agriculture production process.

Increasing demand of water for agriculture and domestic purpose, necessitates study of the availability of water resources along with their scientific use. Agriculture hydrology in recent years has become a subject of major interest in many fields of activity. A knowledge of water movement over land surface, movement into and through the soil, condensation and adsorption of water, evaporation and use of water by crops is necessary for the solution of problems in dryland agriculture.

Contour bunds, graded bunds, contour bunds with open ends, graded border strips are commonly adopted for soil and moisture conservation in dry land agriculture. Bed and furrow method is also practiced in dryland agriculture to conserve more moisture. After every two seed drill width (3 meters) one furrow is opened to increase the moisture conservation in bedding method. It is cheap and easy to install and can be built largely with local implements and labour. Since water spreads laterally from the furrow below the surface bedding into the root zone of the crops, surface evaporation is reduced.

In order to find out the efficiency of bedding method to conserve moisture in red sandy loam soils of BAngalore region the study was done. The present study was takenup by giving water impoundings for different bed widths, in order to find out the "effects of bedding method on moisture conservation", during 1990 at Main Research Station, University of AgriculturalSciences, Hebbal, Bangalore with the following objectives.

1] To know the extent of lateral movement of moisture in the bedding method.

2] To understand the phenomena of downward movement of moisture in the bedding method.

3] To know the change in physical properties of the soil in relation to moisture movement and infiltration.

REVIEW OF LITERATURE

II. REVIEW OF LITERATURE

Contour bunds, graded bunds, contour bunds with open ends, graded border strips are commonly adopted for soil and moisture conservation in dryland agriculture.Bed and furrow method is also practiced in dryland agriculture to conserve more moisture. During rainy days run-off water on the beds is collected in the furrows. This water moves both laterally and vertically from the furrow. Which results in moisture conservation in beds. In order to know the effective width and depth of beds that would get moisture due to impounding of run-off water in the furrows this study has been conducted. Keeping this idea in view the furrows are impounded with water, in order to find out the extent of lateral and vertical soil moisture movement in different bed widths. Much work has not been done in the past to find out the efficiency of bedding method to conserve moisture in dryland agriculture. Therefore, a brief review pertaining to the irrigated and dryland conditions is presented under the following heads:

2.1 Furrow spacing on water use efficiency.

2.2 Infiltration in furrows

2.3 Physical properties of soils in relation to infiltration and moisture retention.

2.4 Soil moisture distribution.

2.1 Furrow spacing on water use efficiency

Box *et al*., (1963) reported that irrigation of alternate 90 cm spaced furrows on a Pullman clay loam did not affect total potato yields when compared with irrigation of every furrow. The alternate furrow irrigation decreased water application by 30 per cent and intake by 13 per cent. However, they concluded that the method of irrigation where every furrow received water was superior in minimizing soil temperature.

Grimes *et al*., (1968) reported that alternate furrow irrigation of cotton on Hospena sandy loam in the San Joaavin valley reduced quantity of irrigation water by 23 per cent. Lint yields were as good or better than every furrow irrigation which received about 15 cm of additional water. Alternate furrow irrigation during vegetative development in May and June reduced vegetative growth and plant height without affecting yield.

Longenecker *et al*., (1969) developed a "variable row spacing" system for irrigated cotton where 200 cm spaced furrows were seperated by wide beds. The space between rows of cotton on each side of the furrow was 66 cm. The wide bed furrow spacing reduced size of seasonal irrigation from 15 cm to 75 cm and water used by 54 per cent compared with conventional 101.6 cm spaced furrows.

Wilke and Smerden (1969) have said that the flow into an irrigation furrow should be controlled so that an equal amount of water is stored in the soil at each point along the furrow length. A uniform distribution of applied water can often be achieved only by having short furrows or by applying a large stream to the furrows.

Musick and Duseck (1971) studied irrigation by alternate furrows in which the furrows were spaced 76 cm and 101.6 cm in Pullman clay loam. Furrow spacing was increased to 152 cm without decreasing yields appreciably. Increasing furrow spacings to 203 cm however, caused considerable yield reduction on the lower end of the field indicating that the spacing was too wide for practical field use in this type of soil. Results from these studies indicated that the non-irrigated furrow did not serve any useful purpose.

New Leon (1971) reported that alternate furrow irrigation (101.6 cm spacing, 800 m long) of grain sorghum on Olton loam in the Texas High Plains reduced average size of 5 irrigations by one-third. The low water intake reduced grain yields from 1427 to 1252 Kg per ha. In a separate trail, water applied during five irrigations to alternate furrows equalled the amount applied during four irrigations to every furrow. The alternate furrow method resulted in slightly increased yields.

Allen and Musick (1972) tried a wide bed furrow system for irrigation of winter wheat and grain sorghum on a slowly permeable clay loam in the southern high plains. The system consisted of 152 cm spaced furrows separating relatively broad flat beds about 101 cm wide. The wide bed furrow system was compared with conventional 101 cm bed furrows. Yields from 152 cm bed furrows were similar to 101 cm conventional bed furrows during a winter irrigation of wheat, but averaged 23 per cent less during three spring irrigations and 19 per cent less during two seasonal irrigations of grain sorghum.

Stone *et al.*, (1979) reported that wide spaced furrow irrigation usually required about half the water of narrow spacing. In 9 of 11 studies, no yield reductions were observed. Yield reductions were observed due to high atmospheric evaporative demand. Conservation of water from wide spaced furrow irrigation could be possible only in medium to fine textured soils of many semi-arid regions of the world.

Anonymous (1981-82) indicated that the graded border strips and bedding system appears to be promising. While comparing the graded border strips with the bedding system, bedding system gave higher yields than graded border strips.

Stone *et al.*, (1982) reported that wide spaced furrow irrigation applies water to the root zone while maintaining a relatively dry soil surface. This condition reduced evapotranspiration losses and can reduce water requirement by 20-50 per cent.

Hodges et al., (1989) reported that wide spaced furrow irrigation treatment did not cause greater yield variation down the furrow than the every furrow irrigation treatment, although about half of the water was applied to the wide spaced furrow irrigation plots as compared to every furrow irrigation. In the widespaced furrow irrigation treatments, all the furrows were not irrigated at one time and often cracking was observed in dry furrows. Subsequent irrigations to the cracked dry furrows significantly increased the penetration of water into the profile than to the every furrow irrigation treatments. Soil water tended to be depleted to greater degree in the wide spaced furrow irrigation treatments than the every furrow irrigation treatments over the growing season. But seasonal evapotranspiration was lower in the wide spaced furrow irrigation plots.

2.2 Infiltration in furrows

Smedema (1980) reported that in furrow irrigation the initial water intake in the dry cracked vertisols was extremely high when the soil has been fully replenished. The infiltration rate reduced to a negligible value making the water of these soils a self-regulating self-ending process.

Gunton (1981) tried the irrigation rate of three furrow shapes were compared with profile shapes of normal V, double V and broad based system. The double V type system increased the infiltration rates under all conditions tested. The advantage of the double V-shape was ascribed to the increased wetted surface area and to the greatly reduced rate of water advance down the furrow.

Eisenhauer *et al.*, (1982) observed that the reduced tillage systems increased water advance time by 62 per cent on furrow irrigation and net infiltration by 74 per cent as compared to conventional tillage practices.

Stelkoff and Souza (1984) reported that the water depth in furrows primarily influenced on infiltration rate. In flow depth remains relatively constant every where and infiltration parameters are measured at that depths, volume infiltrated per unit length computed in a mathematical model of furrow flow depends only on the time of stream arrival. But a significant depth gradient results in error unless the variable depth is incorporated into the infiltration computation.

Bautista and Wallender (1985) observed that infiltration rate is generally greater with water flowing in blocked furrows than stagnant water, especially on cracked soil. Spatial variability of infiltration characteristics could be included in evaluating the performance of furrow irrigation system.

Trout and Mackey (1985) reported that furrow variability of irrigation water application was about twice as great with gated pipe and feed ditches with siphon tubes. The measured furrow infiltration coëfficient of variation was 25 per cent which causes farmers to irrigate 27 per cent more water to meet irrigation requirements over 80 per cent of furrows. Inflow and infiltration variability caused larger furrow to furrow run-off variability with higher erosion and sediment losses.

Izadi and Wallender (1985) reported that under flowing conditions, than stagnant water increased the intake of water on cracked Yolo clay loam. Where as rapidly increasing surface flow depth enhanced infiltration on the same soil with fewer cracks. Significant cross correlation between wetted perimeter and infiltration was observed with cracks and holes which did not dominate the infiltration rate.

Katyal et al., (1987) reported that the cumulative infiltration was a function of time and top width of water in the furrow.

Brown et al., (1988) observed that fine sediment adsorbed on the perimeter reduced the intake and increased the soil water tension which was the primary mechanism holding the sediment on the perimeter.

2.3 Physical properties of soils in relation to infiltration and moisture retention

Agarwal et al., (1974) reported that in varied texture of three soils infiltration rate was decreased with decreasing sand content and increasing silt plus clay content.

Nijhawan and Garg (1975) conducted laboratory studies on undisturbed cores of soils of varying texture and observed that decrease in infiltration rate with successive additions of water was not dependent on soil texture but controlled by water stable aggregates and later by dispersion coėfficient of silt or silt plus clay.

Sorochkin (1975) found the relation between water infiltration and the physical properties of loam soils and correlation coefficient were established between the infiltration index and physical soil properties, including density, structure, total porosity, moisture content and maximum hygroscopicity.

Joshi and Das (1977) reported that sorptivity, and infiltration rate decreased at higher bulk density and moisture levels. Theoretical values of sorptivity, cumulative influx, infiltration rate, moisture profile and wetting front advancement determination from the unsaturated flow theory of Phillip were in good agreement with experimental values.

Manfredini et al,., (1984) found that the water retention increased while hydraulic conductivity decreased with decreasing mean weight diameter of particles of the sand fraction in latosols and sandy soils.

Ambegaonkar et al., (1984) reported that infiltration rates were higher under ploughing than under no ploughing (or) cropping treatments. This may be attributable to the combined effect of lower initial water content and bulk density.

Ojeniyi and Dexter (1984) observed the significant negative correlations between soil water content and percentage of 4-8 and 8-16 nm voids, mean aggregate size and macroporosity percentage. However inverse relationships were detected between evaporative water loss during day light hours on selected days and mean aggregate size, mean void size and macroporosity percentage. While evaporative water loss during day light hours apparently did not influence the water content of bare soil with a coarse structure at the surface.

Zuidema (1984) reported that the lining of macropores and surface crust may influence strongly the infiltration process.

Madankumar (1985) found that the soil moisture characteristics was established directly from the physical properties of the soil such as, mechanical analysis and bulk densities.

Smettem and Collis-George (1985) observed that the steady state of infiltration was controlled primarily by the size and number of macropores with in the infiltrometer ring.

Antony (1986) found that the moisture retention of red and lateritic soils was poor, due to coarse texture and Kandoid with iron oxide clay minerals. The maximum water holding capacity, field capacity and moisture retained at tensions of 1, 5, 10 and 15 bars were higher in lateritic soils than in red loams. The available water was also higher in lateritic soil than in red loams.

Roldos olivier et al., (1986) reported that the bulk density increased with depth and decreased with increasing water content. In an artificially compacted red ferrallitic soil, infiltration decreased from 1.7 mm per cm^3 to 0.7 mm per minute at the compacted value of 1.28 $gram/cm^3$.

Wood et al., (1987) found that the multiple regression analysis determine the most important factors influencing infiltration and sediment production. viz., soil texture, soil organic matter, bulk density, plant canopy, biomass production, time taken to run-off and ponding. Of all the variables studied, total ground cover was considered to be the most important single variable influencing infiltration and sediment production.

Holzapfel et al., (1988) found that the method adopted for stagnant water gave lower values of infiltration rate than in flowing water.

Paruelo et al., (1988) reported that gravel can withhold upto 67 per cent of the amount of water held by the fine material. Water content at field capacity decreases 50 per cent when gravel content (< 11 mm) which increases from 0 to 40 per cent of total soil weight.

2.4 Soil moisture distribution

Wilke and Smerden (1969) concluded that flow of irrigation water into furrows helped in maintaining an equal amount of water storage in the soil at each point along the furrow length. An uniform distribution of applied water could be seen only by having short furrows or by applying a large stream to the furrows.

Fischback and Mulliner (1972) reported that alternate furrow irrigation to corn on several soil types in Eastern Nebraska produced yields similar to every furrow irrigation. Alternate furrow irrigation (30 cm in furrow spacing) decreased the average size of irrigation in silty clay loam by 29 per cent, grain yield was reduced by 4.7 per cent which was not statistically significant. Electrical resistance block readings before and after irrigation indicated that soil water moving laterally under the non-irrigated furrow to a depth of 3 feet.

Fischback and Mulliner (1974) compared every other furrow irrigation with every furrow irrigation on several soil types under various rainfall conditions. There was no significant differences in corn grain yields on any soil texture between alternate and every furrow irrigation. Their study also indicated that the irrigation water moved laterally from the irrigated furrow to the adjacent dry furrow to a depth of 1 m even with a two and half three hour irrigation test.

Musick and Duseck (1974) evaluated alternate furrow irrigation of bed furrow spacings ranging from 76 to 101 cm for irrigating slowly permeable pullman soils. There was a reduction in water intake and yields on the lower 1/4 to 1/2 of the field plots. Lateral wetting extended from the irrigated furrows into the adjacent non-irrigated furrow past midfield under all conditions evaluated. But it did not wet the lower 1/3 of the field with furrow spacing of 202 cm. Alternate furrow irrigation of bed furrow spacings exceeding 76 cm was not recommended on slowly permeable clay loam soils.

The bedding system increased the yield by about 20 per cent as compared to control. Similarly moisture per cent in the root zone was also considerably higher. It could be concluded that bedding system increases moisture in the root zone by allowing rain water to infiltrate into sub-surface in situ (Anonymous, 1975).

Malik et al., (1987) found that increasing the initial moisture decreased the penetration coefficient in sand and increased in sandy loam and sandy clay loam.

MATERIAL AND METHODS

III. MATERIAL AND METHODS

An experiment was planned and carried out to find out the efficiency of bedding method for moisture conservation, during the period from may to December of 1990 at the Main Research Station, Hebbal, Bangalore. The details of the materials used and the procedure adopted during the course of investigation are presented below.

3.1 Experimental site

The Main Research Station of Agriculture College, Bangalore is situated on the southern part of Karnataka State which is at 13^{o} 58' North latitude and 78^{o} East longitude. The altitude of this farm is 800 meter above the mean sea level and the experiment was laid out in 'E' block of weed control scheme.

3.2 Soil and its characteristics

The soil of the experimental site was sandy loam. Composite soil samples were drawn from the 0-15, 15-30 and 30-45 cm depths and were analysed for some of their physico-chemical properties. The methods employed for the determination and the results obtained are furnished in Table 1.

3.3 Climate

The area receives an average annual rainfall of about 800 mm fairly well distributed from May to November and was

TABLE 1 Physico-chemical properties of soil

Sl. No.	Particulars	Soil depth (cm)			Average	Method employed for determination
		0-15	15-30	30-45		
Physical Properties						
1.	Coarse sand (%)	35.13	26.00	23.00	26.71	Bouyoucos (1962)
2.	Fine sand (%)	39.62	26.75	42.50	34.62	Bouyoucos (1962)
3.	Silt (%)	9.88	11.25	15.70	10.94	Bouyoucos (1962)
4.	Clay (%)	14.37	34.50	18.80	21.89	Bouyoucos (1962)
5.	Bulk density (g/cc)	1.57	1.60	1.62	1.70	Piper (1966)
Chemical Properties						
1.	pH	7.20	6.80	6.70	6.90	Buckman's pH meter (Piper, 1966)
2.	Organic matter (%)	0.90	0.95	0.95	0.93	Walkey and Block method (Jackson, 1973)

was mainly from South-West and North-East Monsoon. Annual rainfall distribution was bimodal in nature. The first peak occurs in the month of July and the second peak occurs during september-October months. Average maximum and minimum temperature was 29.71^{o}C and 18.49^{o}C. The relative humidity fluctuates from 55.50 to 75.90 per cent (Average of TT years).

The maximum and minimum temperatures recorded during the time when the experiment was carried out ranges from 26.7^{o}C.to34.9^{o}C and from 12.40^{o}C to 22.30^{o}C, respectively. The total rainfall received during the period when the experiment was carried out is 332.2 mm. The details on meteorological data are furnished in the Appendix 1A And 1B and Figure 1A And 1B.

3.4 Experimental details

The field experiment was carried out to study the efficiency of bedding method on moisture conservation during the period from May to December 1990. The details of the experiment are given in the following sub-headings.

3.4.1 Treatments

The experiment consisted 12 treatment combinations with four levels of bed widths and three levels of impoundings.

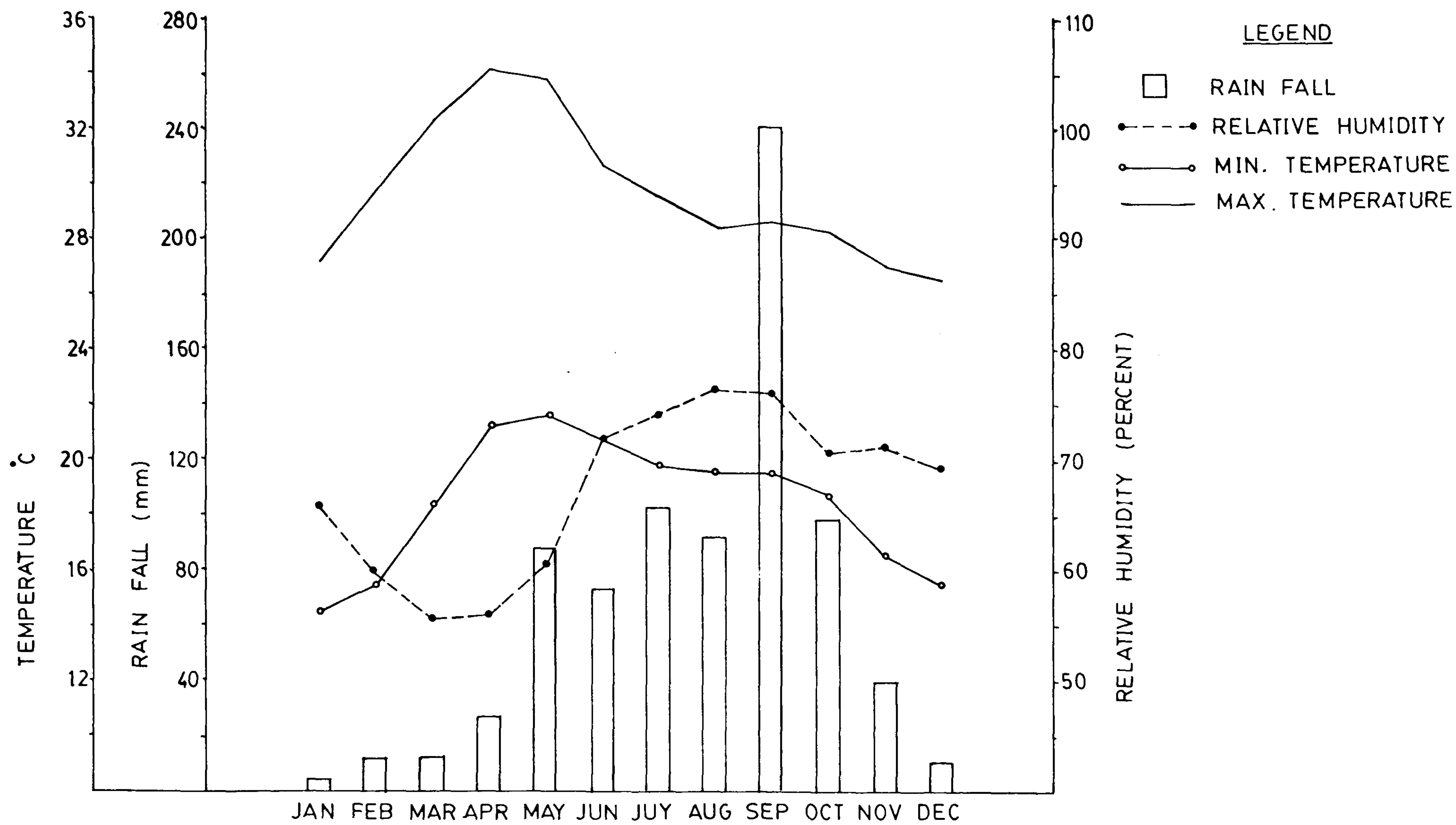


FIG-1A, CLIMATOLOGICAL DATA OF MAIN RESEARCH STATION U.A.S. HEBBAL (AVERAGE OF 11 YEARS 1979-89).

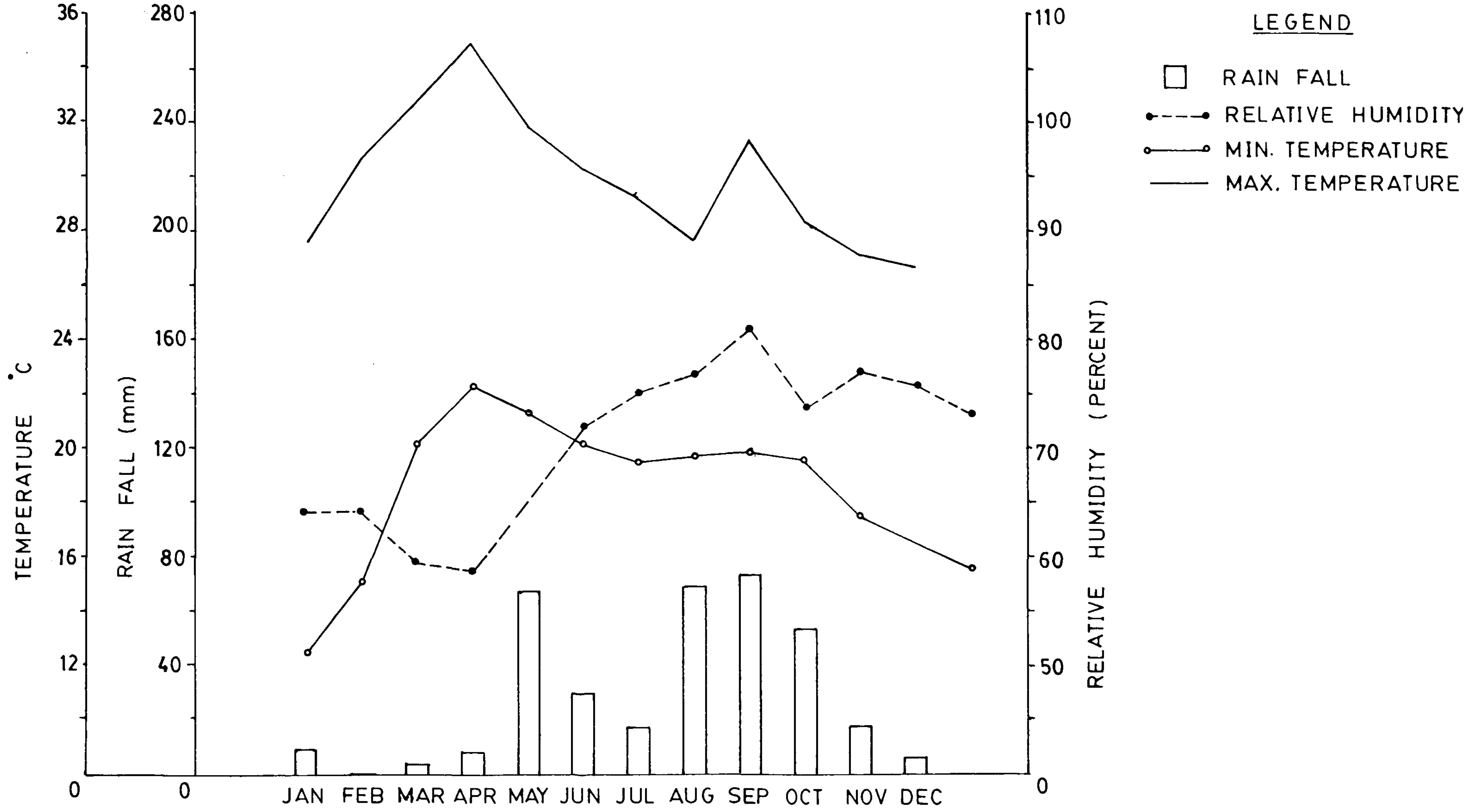


FIG-1B, CLIMATOLOGICAL DATA OF MAIN RESEARCH STATION FOR THE YEAR 1990.

A. **Bed widths**

1) 2 meter width .. T_1

2) 3 meter width .. T_2

3) 4 meter width .. T_3

4) 5 meter width .. T_4

B. **Impoundings**

1) One impounding .. I_1

2) Two impoundings at a time .. I_2

3) Three impoundings at a time .. I_3

Treatment combinations

1.	T_1I_1	7.	T_3I_1
2.	T_1I_2	8.	T_3I_2
3.	T_1I_3	9.	T_3I_3
4.	T_2I_1	10.	T_4I_1
5.	T_2I_2	11.	T_4I_2
6.	T_2I_3	12.	T_4I_3

The plan of the layout of the experiment is given in Fig.2.

3.5 Cultural practices

3.5.1 Land preparation and layout of beds

The land was ploughed by Tractor mounted disc plough one week after wetting the field. This was followed by disc harrowing once to crush the clods. Stubbles were collected and the land was made clean.

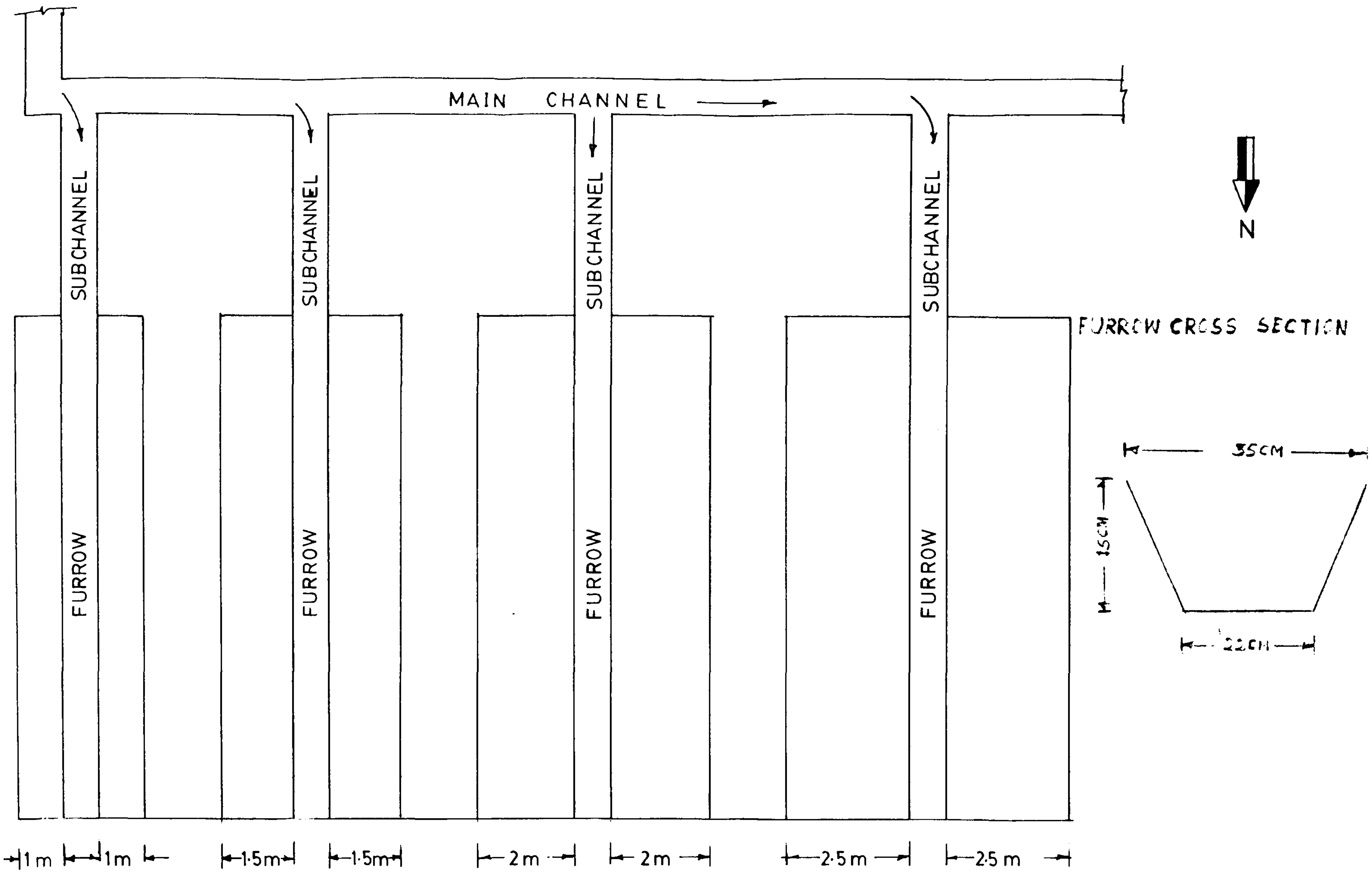


FIG-2, LAYOUT OF THE EXPERIMENT.

The beds were laid out with 2, 3, 4 and 5 meters width. Half the width of the each bed is taken on either side of the furrow. In case of 2, 3, 4 and 5 meter bed widths 1, 1.5, 2 and 2.5 meter widths were taken on either side of the furrow. The shape of the furrow cross-section was trapizoidal with the following dimensions.

35 cm top width

22 cm bottom width

15 cm depth

3.5.2 Irrigation

Bedding method was commonly practiced in dryland agriculture to conserve more moisture. During rainy days run-off water on the beds was collected in the furrows, and this run-off water moves laterally and vertically from the furrow causing moisture conservation in beds. Keeping these things in view the furrows are impounded with water, in order to find out the extent of lateral and vertical soil moisture movement in different bed widths. Commonly adopted furrow size in the bedding method was adopted in this experiment.

Each treatment was irrigated separately. The volume of water delivered to the furrow was measured by using a 90^{o} V notch. (Michael et al., 1972). Number of impoundings, total quantity of water delivered, volume of water infiltrated while applying, volume of the furrow, are furnished in the Table 2. The water delivered to the furrow was cut-off once

Table 2. Details of number of impoundings, total quantity of water applied, total volume of the furrow, volume of water infiltrated during the time of application during the experiment.

Treatment		Height of water over V Notch (cm)	Dis-charge (litre/ second)	Total time (min)	Total quantity of water applied (m^3)	Total volume of the furrow (m^3)	Volume of water infiltrated during the time of application (m^3)
1		2	3	4	5	6	7
T_1I_1		6.00	1.20	4.00	0.288	0.214	0.074
T_1I_2	i_1	4.50	0.60	7.00	0.252	0.214	0.038
	i_2	4.50	0.60	6.25	0.225	0.214	0.011
T_1I_3	i_1	5.00	0.80	6.00	0.288	0.214	0.074
	i_2	5.00	0.80	5.00	0.240	0.214	0.026
	i_3	5.00	0.80	4.50	0.216	0.214	0.002
T_2I_1		6.30	1.37	3.00	0.247	0.214	0.033
T_2I_2	i_1	6.50	1.50	3.00	0.270	0.214	0.056
	i_2	6.50	1.50	2.50	0.225	0.214	0.011
T_2I_3	i_1	5.50	1.00	4.50	0.270	0.214	0.056
	i_2	5.00	0.80	3.75	0.225	0.214	0.011
	i_3	5.00	0.80	4.50	0.216	0.214	0.002
T_3I_1		6.50	1.50	3.16	0.284	0.214	0.070
T_3I_2	i_1	6.00	1.20	3.75	0.270	0.214	0.056
	i_2	6.00	1.20	3.25	0.234	0.214	0.020
T_3I_3	i_1	6.00	1.20	4.08	0.293	0.214	0.079
	i_2	6.00	1.20	3.50	0.252	0.214	0.038
	i_3	6.00	1.20	3.08	0.221	0.214	0.007
T_4I_1		6.00	1.20	4.00	0.288	0.214	0.074
T_4I_2	i_1	6.50	1.50	3.25	0.293	0.214	0.079
	i_2	6.50	1.50	2.75	0.248	0.214	0.034
T_4I_3	i_1	6.00	1.20	4.00	0.288	0.214	0.074
	i_2	6.00	1.20	3.20	0.230	0.214	0.016
	i_3	6.00	1.20	3.00	0.216	0.214	0.002

Plate 1a & 1b : Using of 90^{o}V Notch for measuring inlet of water

the furrow was completely filled. Point gauge was used to measure the infiltration rate in the furrow, until the water completely infiltrated into the soil.

For one impounding (I_1) the infiltration rate was measured at regular intervals, until the water completely infiltrated into the soil. For two impoundings (I_2) immediately after the infiltration of first impounding second impounding was given, for both the impounding infiltration rate was measured, until the water completely infiltrated into the soil. For three impoundings (I_3) immediately after the infiltration of first impounded water, second impounding was given, after the infiltration of second impounded water, third impounding was given. For all three impoundings, infiltration rate was measured at a regular intervals, until the water completely infiltrated into the soil.

3.6 Soil moisture distribution

Lateral and vertical soil moisture movement from the edge of the furrow in different bed widths for three levels of water impoundings was studied, separately. The soil samples were drawn from both the sides of the beds at a lateral distance of 0, 50 and 100 cm (from the edge of the furrow) in case of 2 meter bed width (T_1). At each lateral distance soil samples were collected from 0, 15, 30 and 45 cm vertical depths.

Plate 2a & 2b : Measurement of infiltration rate by using point guage
(in furrows)

The soil samples were drawn from both the sides of the beds at a lateral distance of 0, 50, 100 and 150 cm (from the edge of the furrow) in case of 3 meter bed width (T_2). At each lateral distance soil samples were collected from 0, 15, 30 and 45 cm vertical depths.

In case of 4 meter bed width (T_3), the soil samples were drawn from both the sides of the beds at a lateral distance of 0, 50, 100 and 200 cm (from the edge of the furrow). At each lateral distance, soil samples were collected from 0, 15, 30 and 45 cm vertical depths.

Similarly in 5 meter bed width (T_4) the soil samples were drawn from both the sides of the beds at a lateral distance of 0, 50, 100, 150, 200 and 250 cm (from the edge of the furrow). At each lateral distance soil samples were collected from 0, 15, 30 and 45 cm vertical depths.

3.7 Statistical analysis and interpretation of data

The analysis of variance technique was carried out considering the 2-way analysis with more than one observation per cell.

The value of F and critical difference (C.D.) at 5 per cent were calculated by following the method outlined for two way analysis with more than one observation per cell.

EXPERIMENTAL RESULTS

IV. EXPERIMENTAL RESULTS

A field experiment was conducted at the Main Research Station, Hebbal, Bangalore, during the period of May to December 1990, to find out the efficiency of Bedding method on moisture conservation. The results obtained during the course of investigation are presented below.

4.1 Number of impoundings and infiltration in 2 meter bed width

Water delivered to the furrow during each impounding was measured separately by using 90^{O} V Notch. The infiltration rate was measured by using point gauge at regular intervals until the water completely infiltrated into the soil.

4.1.1 One impounding

The details of infiltration for one impounding are presented in Table 3, and depicted in the Figure3a. The infiltration in the first four minutes was as high as 18.75 cm per hour. The rate of infiltration decreased with the elapsed time. The infiltration attained almost constant after 80 minutes, at the rate of 3.75 cm per hour, until the water completely disappeared into the soil. The total time taken for complete infiltration was 112 minutes.

4.1.2 Two impoundings

The details of infiltration for the two impoundings are presented in Table 3 and depicted in the Figure 3b. The rate

TABLE 3 : **Impounding of water and infiltration in 2 meter bed width**

One Impounding		Two impoundings at a time					
		First impounding		Second impounding			
Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)
4	18.75	4	17.05	4	6.75	132	3.75
8	10.50	8	13.50	8	6.00	136	3.75
12	9.30	12	9.15	12	6.00	140	3.75
16	8.25	16	9.00	16	6.00	144	3.75
20	7.50	20	8.10	20	6.00	148	3.75
24	7.50	24	7.50	24	6.00	152	3.75
28	6.75	28	7.50	28	6.00	156	3.75
32	6.75	32	7.50	32	6.00	160	3.75
36	6.75	36	7.50	36	5.40	164	3.75
40	6.75	40	7.35	40	5.40	168	3.75
44	6.00	44	7.35	44	5.40	172	3.75
48	6.00	48	6.15	48	5.40		
52	5.25	52	6.15	52	5.40		
56	5.25	56	6.15	56	5.40		
60	5.25	60	6.15	60	5.40		
64	5.10	64	6.15	64	5.40		
68	5.10	68	6.15	68	5.40		
72	5.10	72	6.15	72	4.80		
76	5.10	76	6.15	76	4.80		
80	4.50	80	5.25	80	4.80		
84	3.75	84	5.25	84	4.50		
88	3.75	88	5.25	88	4.50		
92	3.75	92	5.25	92	4.50		
96	3.75	96	6.25	96	4.50		
100	3.75	100	4.80	100	4.50		
104	3.75	104	4.80	104	4.50		
108	3.75	108	4.80	108	4.20		
112	3.75	112	4.80	112	4.20		
		116	4.80	116	4.20		
		120	4.80	120	4.20		
		124	4.80	124	3.75		
		128	4.80	128	3.75		

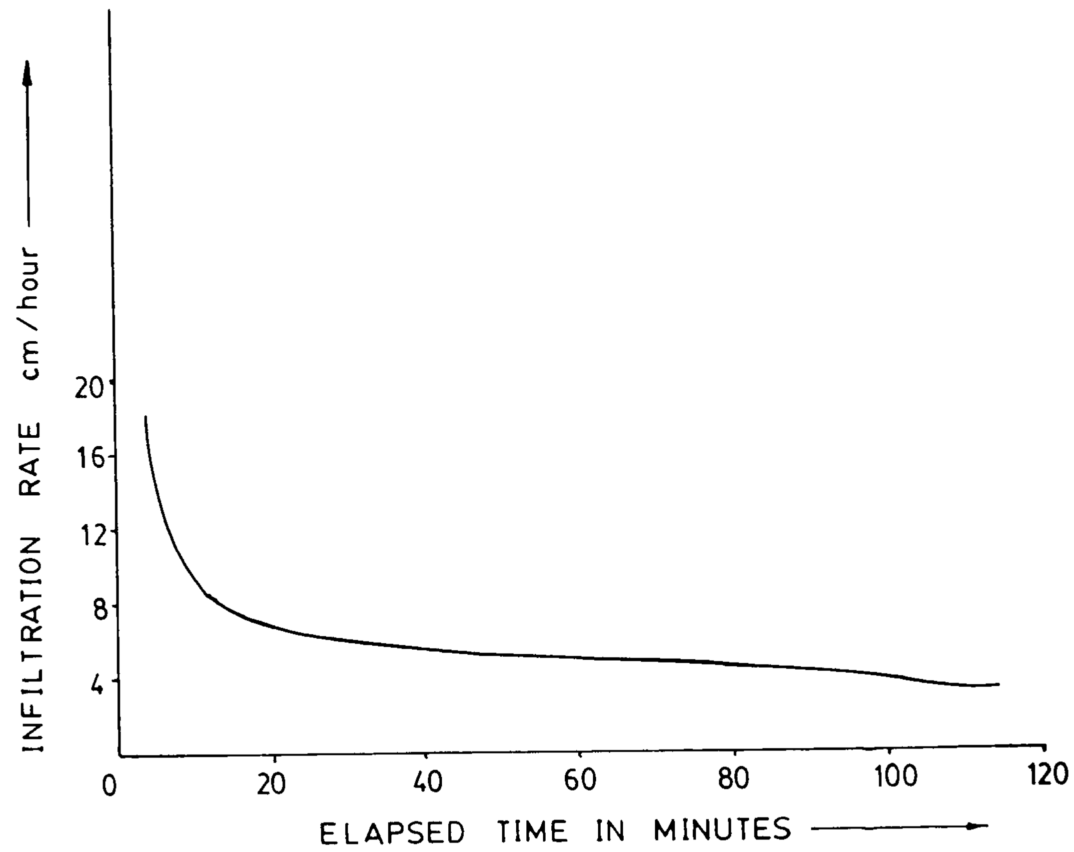


FIG-3A, RELATIONSHIP OF ONE IMPOUNDING OF WATER AND INFILTRATION IN TWO METER BED WIDTH.

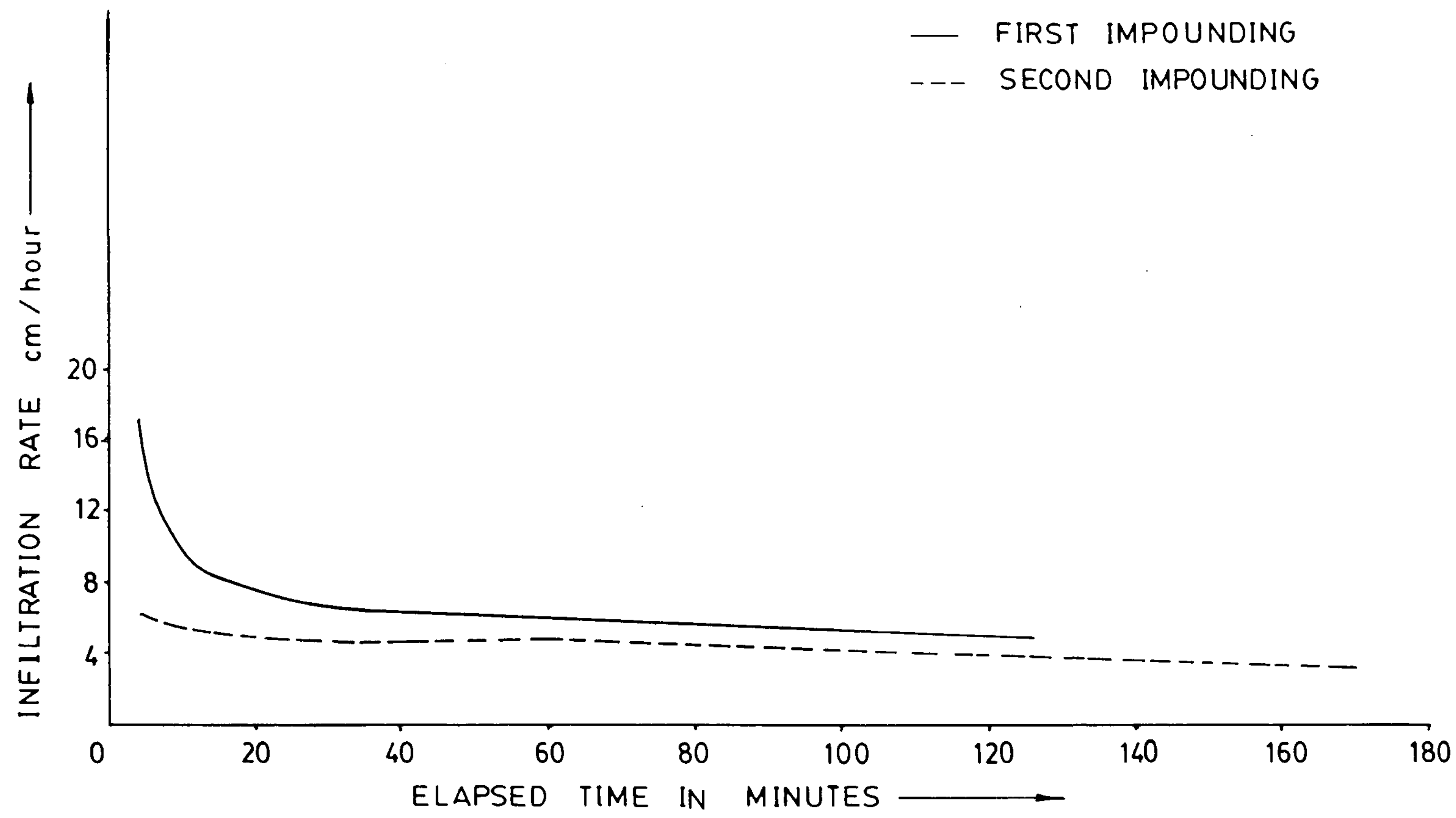


FIG-3B, RELATIONSHIP OF TWO IMPOUNDINGS OF WATER AND INFILTRATION IN TWO METER BED WIDTH.

of infiltration in the first four minutes was as high as 17.85 cm per hour for the first impounding. The rate of infiltration decreased with the elapsed time. The infiltration attained almost constant after 96 minutes at the rate of 4.8 cm per hour, until the water completely infiltrated into the soil. The total time taken for the complete infiltration was 172 minutes.

4.1.3 Three impoundings

The details of infiltration for the three impoundings are presented in the table 4 and depicted in the Fugure 4. The infiltration rate in the first 12 minutes was as high as 12.0 cm per hour. The infiltration rate attained almost constant after 84 minutes at the rate of 4.70 cm per hour, until the water completely disappeared into the soil. The total time taken for complete infiltration was 120 minutes.

The rate of infiltration in the first 12 minutes was 6.25 cm per hour for the second impounding. The rate of infiltration attained almost constant after 120 minutes at the rate of 4.25 cm per hour, until the water completely infiltrated into the soil. The total time taken for complete infiltration was 168 minutes.

The rate of infiltration in the first 12 minutes was 4.70 cm per hour for the third impounding. The infiltration rate decreased with the elapsed time. The infiltration

TABLE 4 Impounding of water and infiltration in two meter bed width

Three impoundings at a time					
First impounding		Second impounding		Third impounding	
Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)
12	12.00	12	6.25	12	4.70
24	10.40	24	5.50	24	4.55
36	7.55	36	5.00	36	4.50
48	6.45	48	5.00	48	4.50
60	5.50	60	4.70	60	4.30
72	5.20	72	4.70	72	4.30
84	5.20	84	4.70	84	4.30
96	4.70	96	4.50	96	4.30
108	4.70	108	4.50	108	3.95
120	4.70	120	4.35	120	3.95
		132	4.25	132	3.60
		144	4.25	144	3.50
		156	4.25	156	3.50
		168	4.25	168	3.50
				180	3.50
				192	3.50
				204	3.50
				21	3.50
				228	3.50

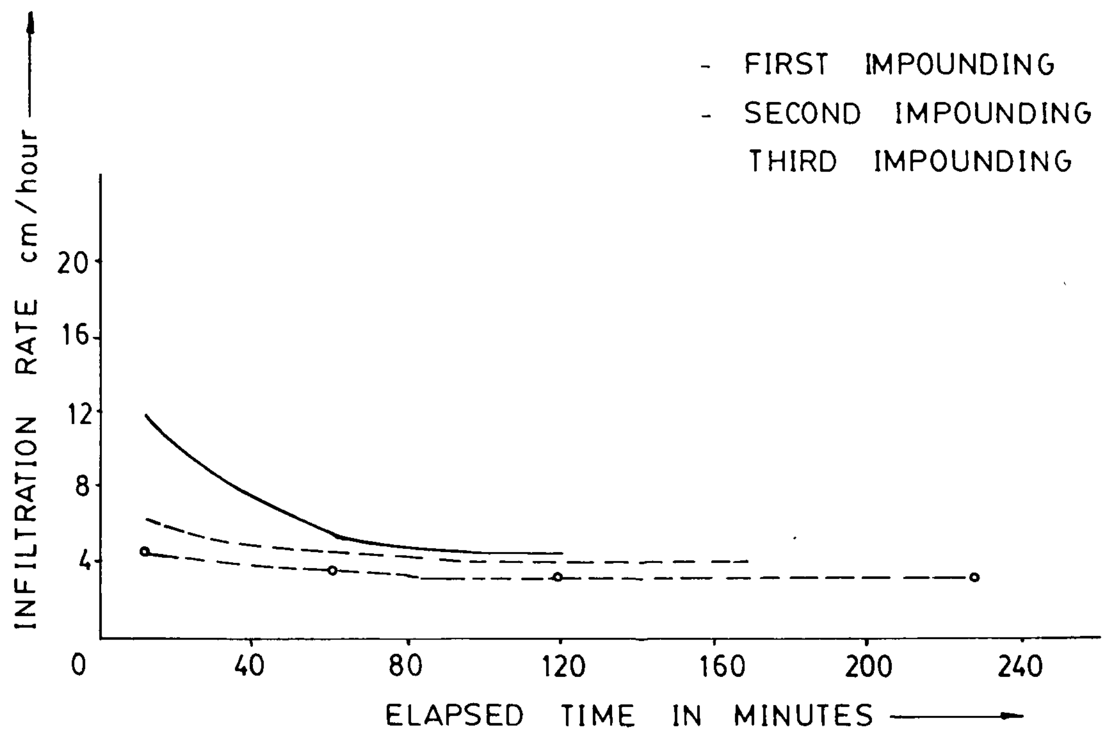


FIG-4. RELATIONSHIP OF THREE IMPOUNDINGS OF WATER AND INFILTRATION IN TWO METER BEDWIDTH.

attained almost constant after 132 minutes at the rate of 3.5 cm per hour, until the water completely disappeared into the soil. The total time taken for complete infiltration was 228 minutes.

4.2 Number of impoundings and infiltration in 3 meter bed width

Water delivered to the furrow during each impounding was measured by using 90^{o}V Notch. Point gauge was used to measure the infiltration rate at regular intervals, until the water completely infiltrated into the soil.

4.2.1 One impounding

The details of infiltration for the one impounding are presented in Table 5 and depicted in the Figure 5A. The infiltration in the first four minutes was as high as 19.8 cm per hour. The rate of infiltration decreased with the elapsed time. The infiltration rate attained almost constant after 92 minutes at the rate of 4.95 cm per hour. The total time taken for complete infiltration was 124 minutes.

4.2.2 Two impoundings

The details of infiltration for the two impoundings are presented in the Table 5 and depicted in the Figure 5B. The infiltration in the first four minutes was as high as 15.45 cm per hour for the first impounding. The rate of infiltration decreased with the elapsed time. The

TABLE 5 : Impounding of water and infiltration in three meter bed width

One impounding		Two impoundings at a time			
		First impounding		Second impounding	
Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)
4	19.80	4	15.45	4	5.25
8	13.35	8	9.75	8	4.50
12	11.05	12	8.55	12	4.50
16	10.05	16	7.35	16	4.50
20	9.75	20	6.00	20	4.50
24	9.00	24	6.00	24	4.50
28	8.25	28	6.00	28	4.50
32	8.25	32	6.00	32	4.50
36	7.50	36	5.40	36	4.50
40	7.50	40	5.40	40	3.90
44	7.50	44	5.40	44	3.90
48	7.05	48	5.40	48	3.90
52	6.60	52	5.40	52	3.90
56	6.60	56	5.40	56	3.90
60	6.60	60	5.40	60	3.90
64	6.00	64	5.40	64	3.90
68	6.00	68	5.40	68	3.90
72	6.00	72	4.50	72	3.45
76	5.40	76	4.50	76	3.45
80	5.40	80	4.35	80	3.00
84	5.40	84	4.20	84	3.00
88	5.40	88	4.20	88	3.00
92	5.40	92	4.20	92	3.00
96	4.95	96	4.20	96	3.00
100	4.95	100	4.20	100	3.00
104	4.95	104	4.20	104	3.00
108	4.95	108	4.20	108	3.00
112	4.95	112	3.75	112	3.00
116	4.95	116	3.75	116	3.00
120	4.95	120	3.75	120	3.00
124	4.95	124	3.75	124	3.00
		128	3.75	128	3.00
		132	3.75	132	3.00
		136	3.75	134	3.00
		140	3.75	136	3.00
		144	3.75	140	3.00
		148	3.75	144	3.00
		152	3.75	148	3.00
		156	3.75	152	3.00
				156	3.00
				160	3.00
				164	3.00
				168	3.00
				172	3.00
				176	3.00
				180	3.00
				184	3.00
				188	3.00
				192	3.00
				196	3.00

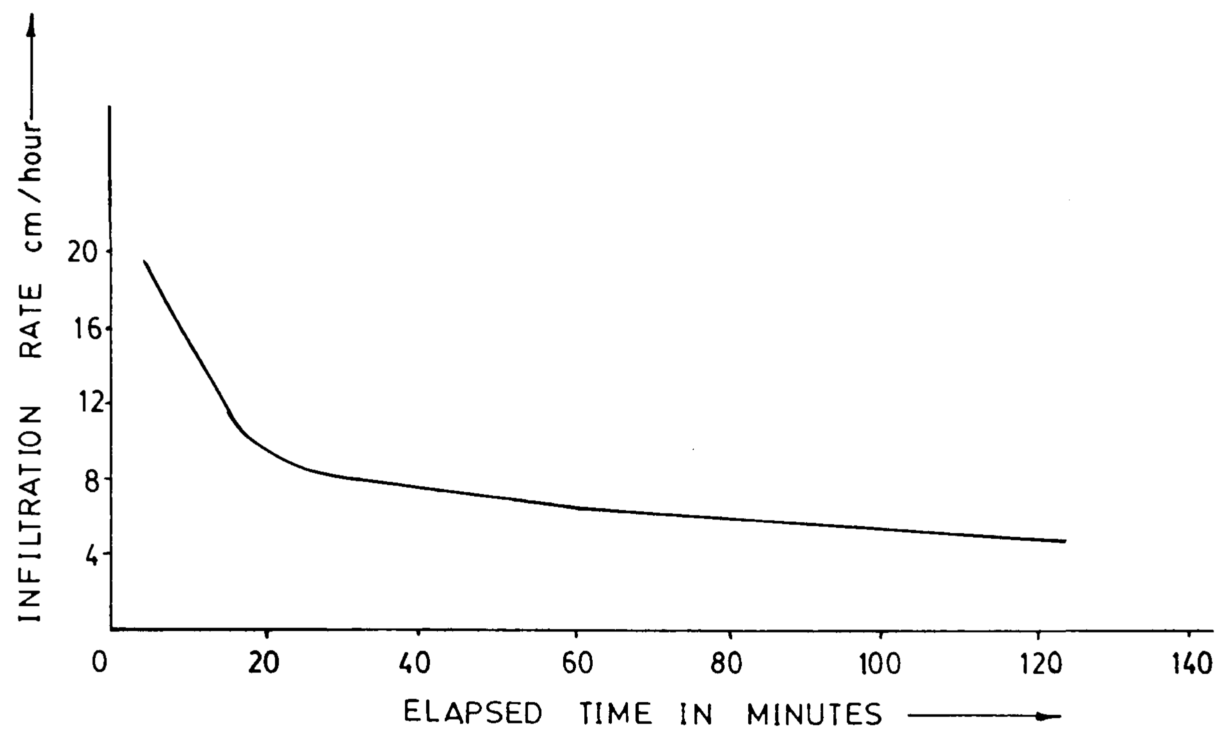


FIG-5A, RELATIONSHIP OF ONE IMPOUNDING OF WATER AND INFILTRATION IN THREE METER BED WIDTH.

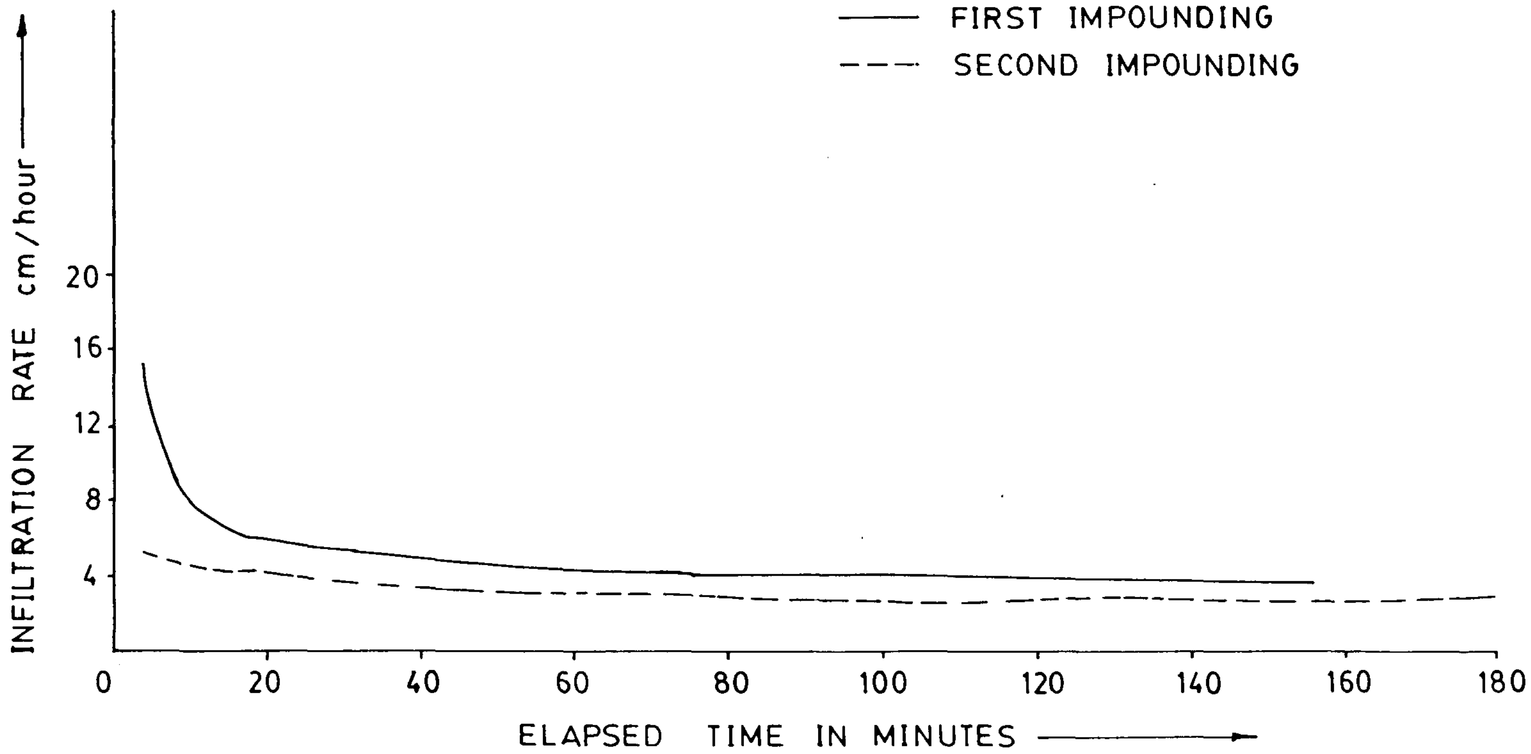


FIG-5B, RELATIONSHIP OF TWO IMPOUNDINGS OF WATER AND INFILTRATION IN THREE METER BED WIDTH.

infiltration attained almost constant after 108 minutes at the rate of 3.75 cm per hour, until the water completely disappeared into the soil. The total time taken for complete infiltration was 156 minutes.

The rate of infiltration in the first four minutes was 5.25 cm per hour for the second impounding. The rate of infiltration decreased with the elapsed time. The infiltration attained almost constant after 76 minutes at the rate of 3.00 cm per hour, until the water completely disappeared into the soil. The total time taken for complete infiltration was 196 minutes.

4.2.3 Three impoundings

The details of infiltration for the three impoundings are presented in the Table 6 and the Figure 6. The infiltration in the first 12 minutes was as high as 10.7cm per hour for the first impounding. The rate of infiltration attained almost constant after 84 minutes at the rate of 3.0 cm per hour. Until the water completely infiltrated into the soil. The total time taken for complete infiltration was 168 minutes.

The rate of infiltration in the first 12 minutes was 5.0 cm per hour for the second impounding. The infiltration attained almost constant after 72 minutes at the rate of 2.5 cm per hour, until the water completely infiltrated into the soil. The total time taken for infiltration was 216 minutes.

TABLE 6 Impounding of water and infiltration in three meter bed width

Three impoundings at a time					
First impounding		Second impounding		Third impounding	
Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)
12	10.70	12	5.00	12	3.20
24	5.80	24	4.20	24	3.00
36	5.60	36	3.15	36	3.00
48	4.00	48	3.15	48	2.75
60	3.40	60	3.15	60	2.50
72	3.15	72	2.85	72	2.50
84	3.05	84	2.50	84	2.50
96	3.00	96	2.50	96	2.50
108	3.00	108	2.50	108	2.50
120	3.00	120	2.50	120	2.50
132	3.00	132	2.50	132	2.20
144	3.00	144	2.50	144	2.20
156	3.00	156	2.50	156	2.20
168	3.00	168	2.50	168	2.20
		180	2.50	180	2.05
		192	2.50	192	2.05
		204	2.50	204	2.05
		216	2.50	216	2.05
				228	2.05
				240	1.90
				252	1.90
				264	1.90
				276	1.90
				288	1.90
				300	1.90
				312	1.90
				324	1.90
				336	1.90

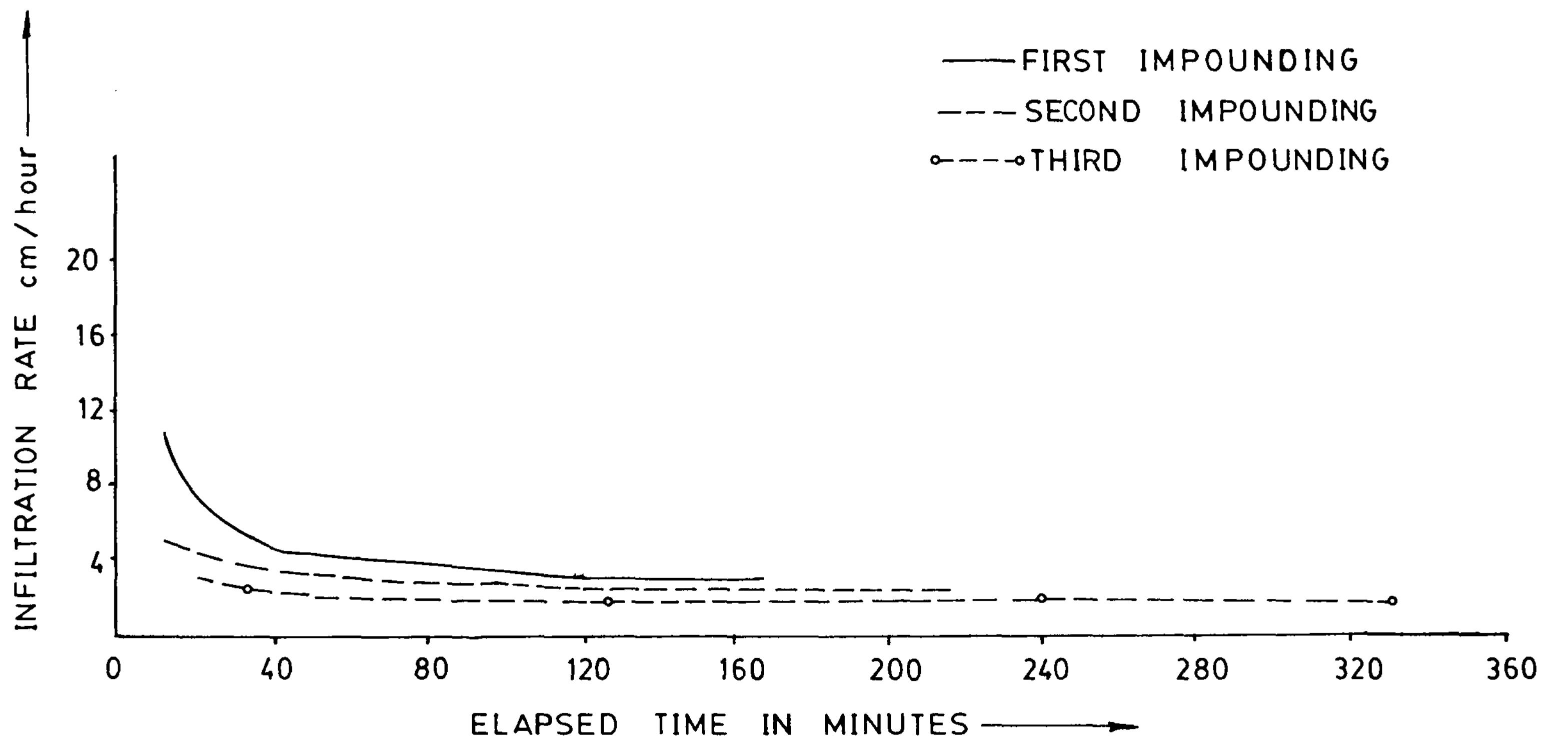


FIG-6, RELATIONSHIP OF THREE IMPOUNDINGS OF WATER AND INFILTRATION IN THREE METER BED WIDTH.

The rate of infiltration in the first 12 minutes was 3.2 cm per hour for the third impounding. The rate of infiltration decreased with the elapsed time. The infiltration attained almost constant after 228 minutes at the rate of 1.9 cm per hour, until the water completely infiltrated into the soil. The total time taken for complete infiltration was 336 minutes.

4.3 Number of impoundings and infiltration in 4 meter bed width

water delivered to the furrow during each impounding was measured separately by having 90^{o}V Notch. The infiltration rate was measured by using point gauge at regular intervals.

4.3.1 One impounding

The details of infiltration data for one impounding are presented in table 7 and figure 7A. The infiltration in the beginning four minutes was as high as 19.5 cm per hour. The rate of infiltration attained almost constant after 88 minutes at the rate of 6.0 cm per hour, until the water completely infiltrated into the soil. The total time taken for complete infiltration was 108 minutes.

4.3.2 Two impoundings

The details of infiltration for the two impoundings are presented in Table 7 and Figure 7B. The infiltration on the first four minutes was as high as 21.15 cm per hour. The rate

TABLE 7 : **Impounding of water and infiltration in four meter bed width**

One impounding		Two impoundings at a time			
		First impounding		Second impounding	
Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)
4	19.50	4	21.15	4	8.10
8	16.20	8	15.00	8	6.00
12	15.30	12	12.60	12	6.00
16	13.20	16	10.50	16	6.00
20	12.00	20	9.75	20	5.25
24	12.00	24	9.75	24	4.50
28	10.50	28	9.75	28	4.50
32	10.50	32	8.10	32	4.50
36	9.75	36	8.10	36	4.50
40	9.00	40	7.50	40	4.50
44	8.25	44	7.50	44	4.50
48	8.25	48	7.50	48	4.50
52	8.25	52	7.50	52	4.50
56	6.90	56	7.50	56	4.50
60	6.60	60	7.50	60	4.50
64	6.60	64	7.50	64	4.50
68	6.60	68	7.50	68	4.50
72	6.60	72	7.50	72	4.50
76	6.30	76	7.50	76	3.90
80	6.30	80	7.50	80	3.90
84	6.30	84	6.75	84	3.90
88	6.30	88	6.75	88	3.90
92	6.00	92	6.75	92	3.00
96	6.00	96	6.00	96	3.00
100	6.00	100	6.00	100	3.00
104	6.00	104	6.00	104	3.00
108	6.00	108	6.00	108	3.00
		112	6.00	112	3.00
				116	3.00
				120	3.00
				124	3.00
				128	3.00
				132	3.00
				136	3.00
				140	3.00
				144	3.00
				148	3.00
				152	3.00

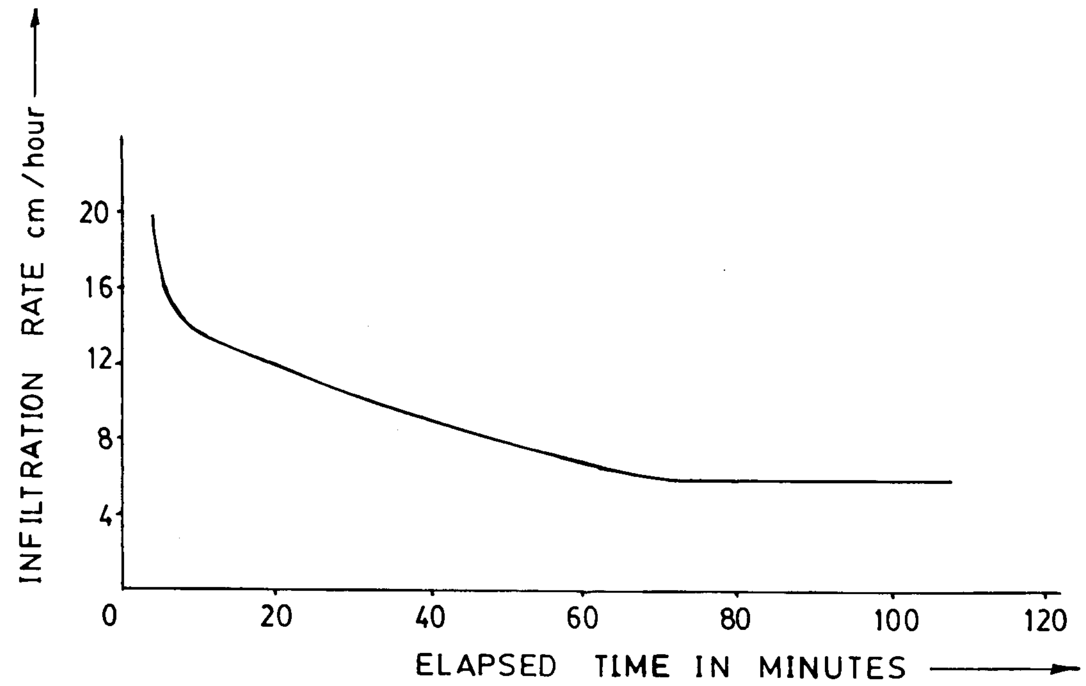


FIG-7A, RELATIONSHIP OF ONE IMPOUNDING OF WATER AND INFILTRATION IN FOUR METER BEDWIDTH.

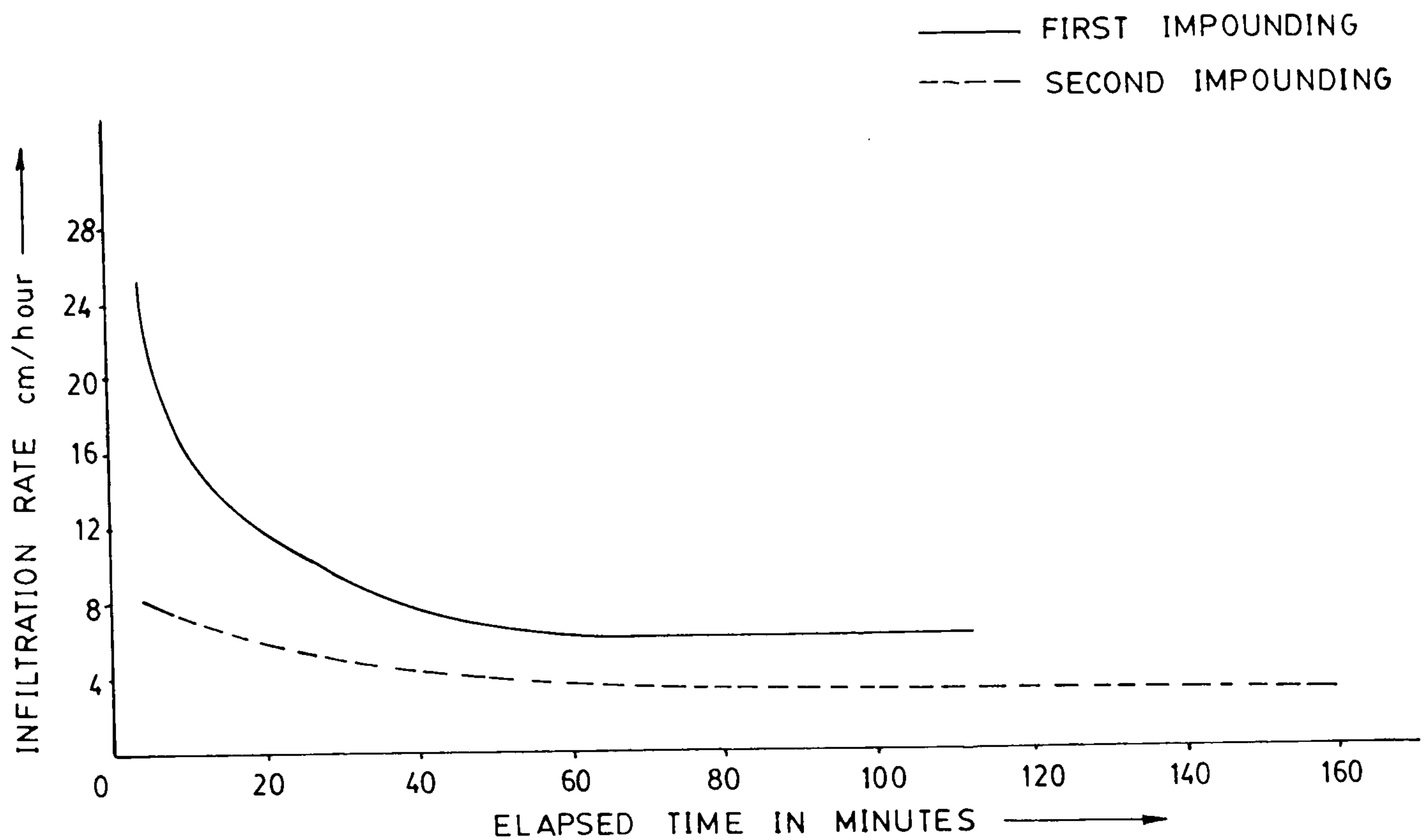


FIG-7B, RELATIONSHIP OF TWO IMPOUNDINGS OF WATER AND INFILTRATION IN FOUR METER BED WIDTH.

of infiltration attained almost constant after 92 minutes at the rate of 6.0 cm per hour, until the water completely infiltrated into the soil. The total time taken for complete infiltration was 112 minutes.

The rate of infiltration in the first four minutes was 8.1 cm per hour for the second impounding. The infiltration rate attained almost constant after 88 minutes at the rate of 3.0cm per hour, until the water completely disappeared into the soil. The total time taken for the complete infiltration was 152 minutes.

4.3.3 Three impoundings

The details of infiltration for the three impoundings are presented in table 8 and in figure 8. The infiltration in the first 12 minutes was as high as 14.00 cm per hour. The rate of infiltration attained almost constant after 60 minutes at the rate of 6.2cm per hour, until the water completely infiltrated into the soil. The total time taken for complete infiltration was 108 minutes.

The rate of infiltration in the first 12 minutes was 7.00 cm per hour for the second impounding. The infiltration attained almost constant after 132 minutes at the rate of 2.6 cm per hour, until the water completely disappeared into the soil. The total time taken for complete infiltration was 228 minutes.

TABLE 8 Impounding of water and infiltration in four meter bed width

Three impoundings at a time					
First impounding		Second impounding		Third impounding	
Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)
12	14.00	12	7.00	12	3.25
24	10.50	24	5.50	24	3.00
36	9.00	36	4.50	36	2.70
48	7.50	48	4.50	48	2.50
60	7.50	60	4.50	60	2.50
72	6.20	72	3.00	72	2.50
84	6.20	84	3.00	84	2.50
96	6.20	96	3.00	96	2.50
108	6.20	108	3.00	108	2.50
		120	3.00	120	2.50
		132	2.50	132	2.50
		144	2.60	144	2.15
		168	2.60	168	2.15
		180	2.60	180	2.15
		192	2.60	192	2.15
		204	2.60	204	2.15
		216	2.60	216	2.15
		228	2.60	228	2.15
				240	2.15
				252	2.15
				264	2.00
				276	2.00
				288	2.00
				300	2.00
				312	2.00
				324	2.00
				336	2.00

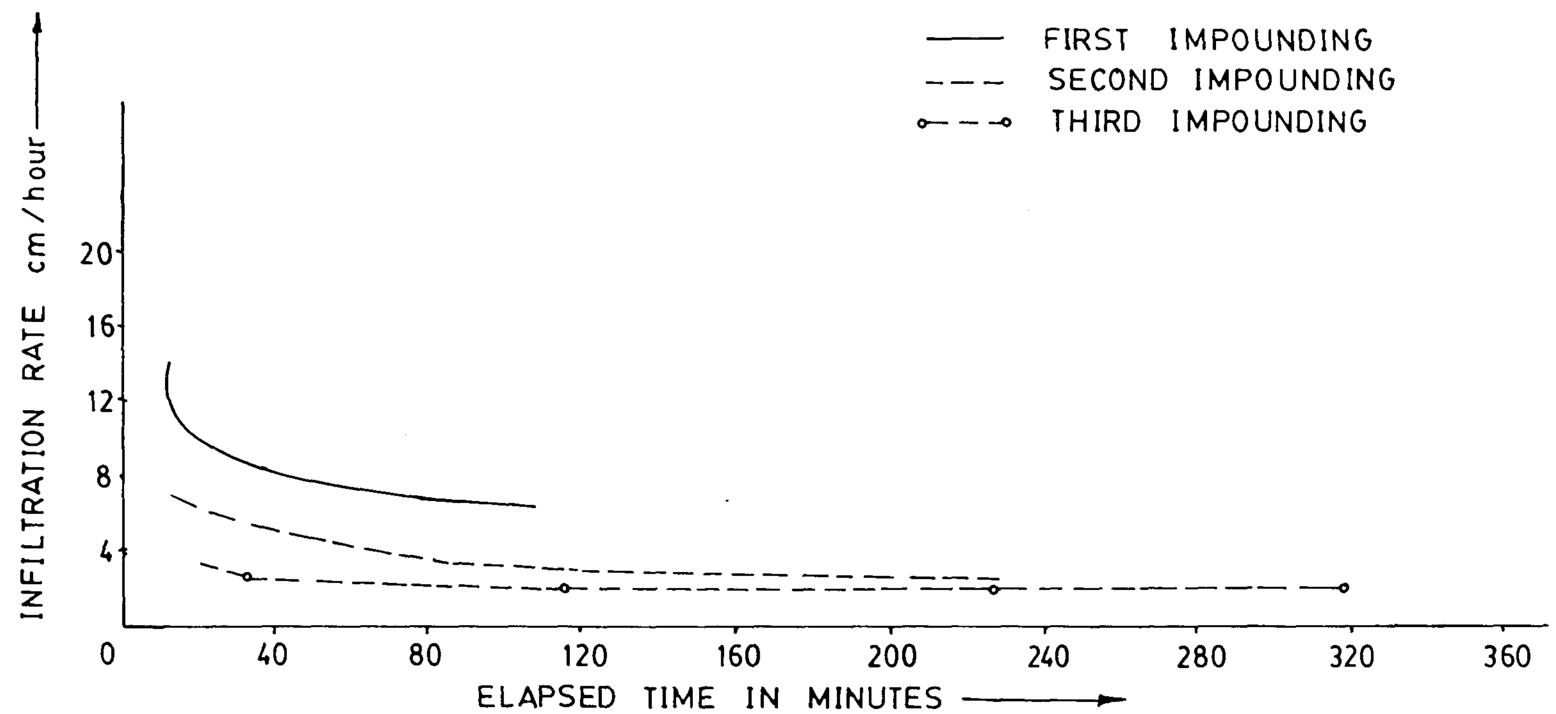


FIG-8, RELATIONSHIP OF THREE IMPOUNDINGS OF WATER AND INFILTRATION IN FOUR METER BEDWIDTH.

The rate of infiltration in the first 12 minutes was 3.25 cm per hour for the third impounding. The infiltration attained almost constant after 252 minutes at the rate of 2.0 cm per hour, until the water completely infiltrated into the soil. The total time taken for complete infiltration was 336 minutes.

4.4 Number of impoundings and infiltration in 5 meter bed width

Water delivered to the furrow during each impounding was measured separately by using 90^{o}V Notch. and infiltration rate was measured by using point gauge at regular intervals.

4.4.1 One impounding

The details of infiltration for the one impounding are presented in table 9 and the figure 9A. The infiltration in the first four minutes was as high as 12.3 cm per hour. The rate of infiltration attained almost constant after 80 minutes at the rate of 4.5 cm per hour, until the water completely infiltrated in the soil. The total time take for complete infiltration was 112 minutes.

4.4.2 Two impoundings

The details of infiltration for the two impoundings are presented in table 9 and the figure 9B. The infiltration rate in the first four minutes was as high as 20.4 cm per hour for the first impounding. The infiltration attained almost

TABLE 9 : **Impounding of water and infiltration in five meter bed width**

One impounding		Two impoundings at a time			
		First impounding		Second impounding	
Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)
4	12.30	4	20.40	4	7.95
8	8.85	8	14.25	8	6.30
12	7.35	12	14.25	12	6.00
16	7.35	16	11.25	16	6.00
20	6.75	20	10.35	20	6.00
24	6.75	24	9.00	24	6.00
28	6.75	28	9.00	28	6.00
32	6.75	32	9.00	32	6.00
36	6.00	36	8.40	36	6.00
40	6.00	40	4.40	40	4.95
44	6.00	44	8.40	44	9.95
48	6.00	48	8.40	48	4.50
52	6.00	52	8.40	52	4.50
56	6.00	56	8.40	56	4.50
60	5.40	60	7.50	60	4.50
64	4.80	64	7.50	64	4.50
68	4.80	68	7.50	68	4.50
72	4.80	72	7.50	72	4.50
76	4.80	76	6.60	76	4.50
80	4.80	80	6.60	80	4.50
84	4.50	84	6.60	84	4.50
88	4.50	88	6.60	88	4.50
92	4.50	92	6.60	92	4.50
96	4.50	96	6.60	96	4.50
100	4.50	100	6.60	100	4.50
104	4.50			104	4.50
108	4.50			108	4.50
112	4.50			112	4.50
				116	4.50
				120	3.90
				124	3.90
				128	3.90
				132	3.90
				134	3.90
				136	3.90
				140	3.90
				144	3.90
				148	3.90
				152	3.90
				156	3.90
				160	3.90
				164	3.90
				168	3.90
				172	3.90
				176	3.90
				180	3.90
				184	3.90
				188	3.90

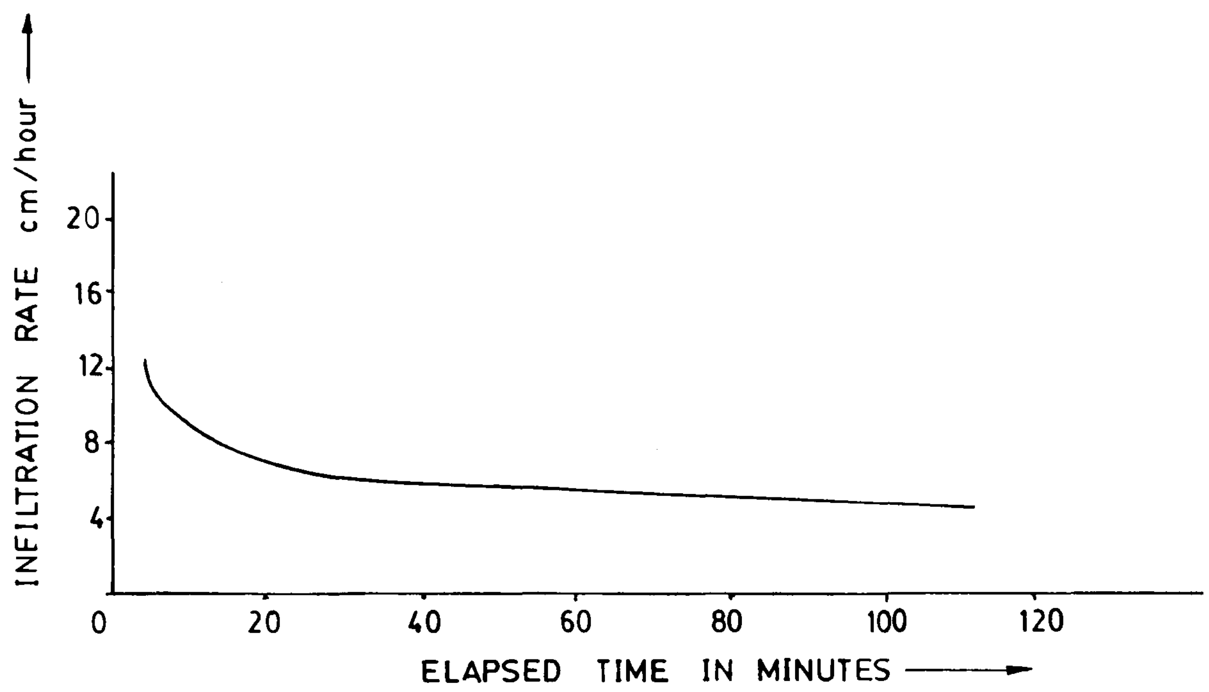


FIG-9A, RELATIONSHIP OF ONE IMPOUNDING OF WATER AND INFILTRATION IN FIVE METER BEDWIDTH.

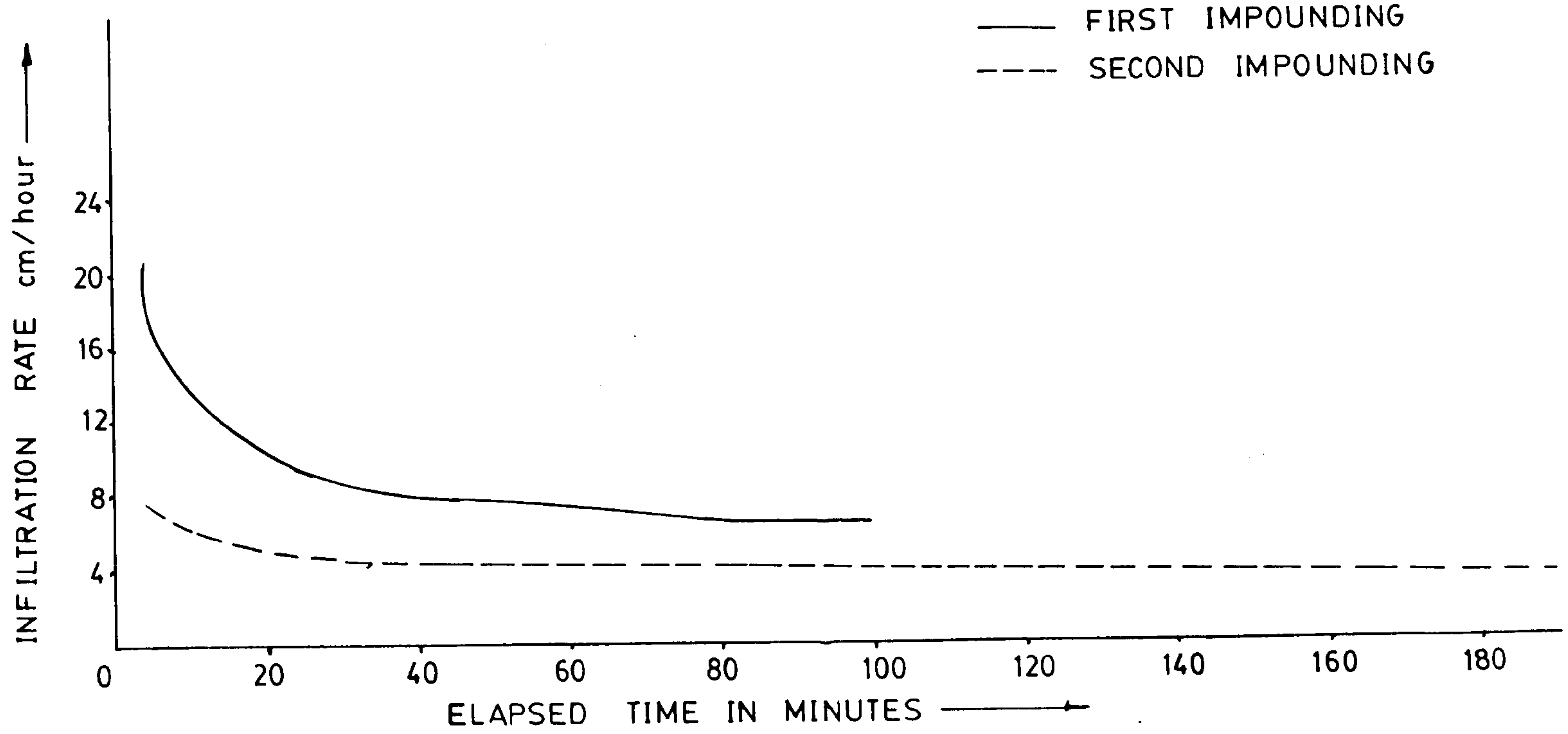


FIG-9B, RELATIONSHIP OF TWO IMPOUNDINGS OF WATER AND INFILTRATION IN FIVE METER BEDWIDTH.

constant after 72 minutes at the rate of 6.6 cm per hour, until the water completely infiltrated into the soil. The total time taken for complete infiltration was 100 minutes.

The rate of infiltration in the first four minutes was 7.95 cm per hour for the second impounding. The infiltration attained almost constant after 116 minutes at the rate of 3.9 cm per hour, until the water completely infiltrated in to the soil. The total time taken for complete infiltration was 188 minutes.

4.4.3 Three impoundings

The details of infiltration for the three impoundings are presented in Table 10 and Figure 10. The infiltration rate in the first 12 minutes was as high as 11.3 cm per hour. The infiltration rate attained almost constant after 84 minutes at the rate of 4.35 cm per hour, until the water completely infiltrated in to the soil. The total time taken for complete infiltration was 132 minutes.

The rate of infiltration in the first 12 minutes was 6.35 cm per hour for the second impounding. The infiltration rate attained almost constant after 144 minutes at the rate of 3.5 cm per hour, until the water complete y infiltrated into the soil. The total time taken for complete infiltration was 204 minutes.

TABLE 10 Impounding of water and infiltration in five meter bed width

Three impoundings at a time					
First impounding		Second impounding		Third impounding	
Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)	Time (min)	Infiltration rate (cm/hr)
12	11.30	12	6.35	12	3.80
24	8.95	24	6.35	24	3.60
36	8.75	36	5.65	36	3.50
48	7.00	48	4.50	48	3.50
60	4.55	60	4.25	60	3.30
72	4.55	72	4.25	72	3.30
84	4.55	84	3.70	84	3.20
96	4.35	96	3.70	96	3.20
108	4.35	108	3.70	108	3.20
120	4.35	120	3.70	120	3.20
132	4.35	132	3.70	132	3.20
		144	3.70	144	3.00
		156	3.50	156	3.00
		168	3.50	168	3.00
		180	3.50	180	3.00
		192	3.50	192	3.00
		204	3.50	204	2.90
				216	2.90
				228	2.75
				240	2.75
				252	2.75
				264	2.75
				276	2.75
				288	2.75
				300	2.75

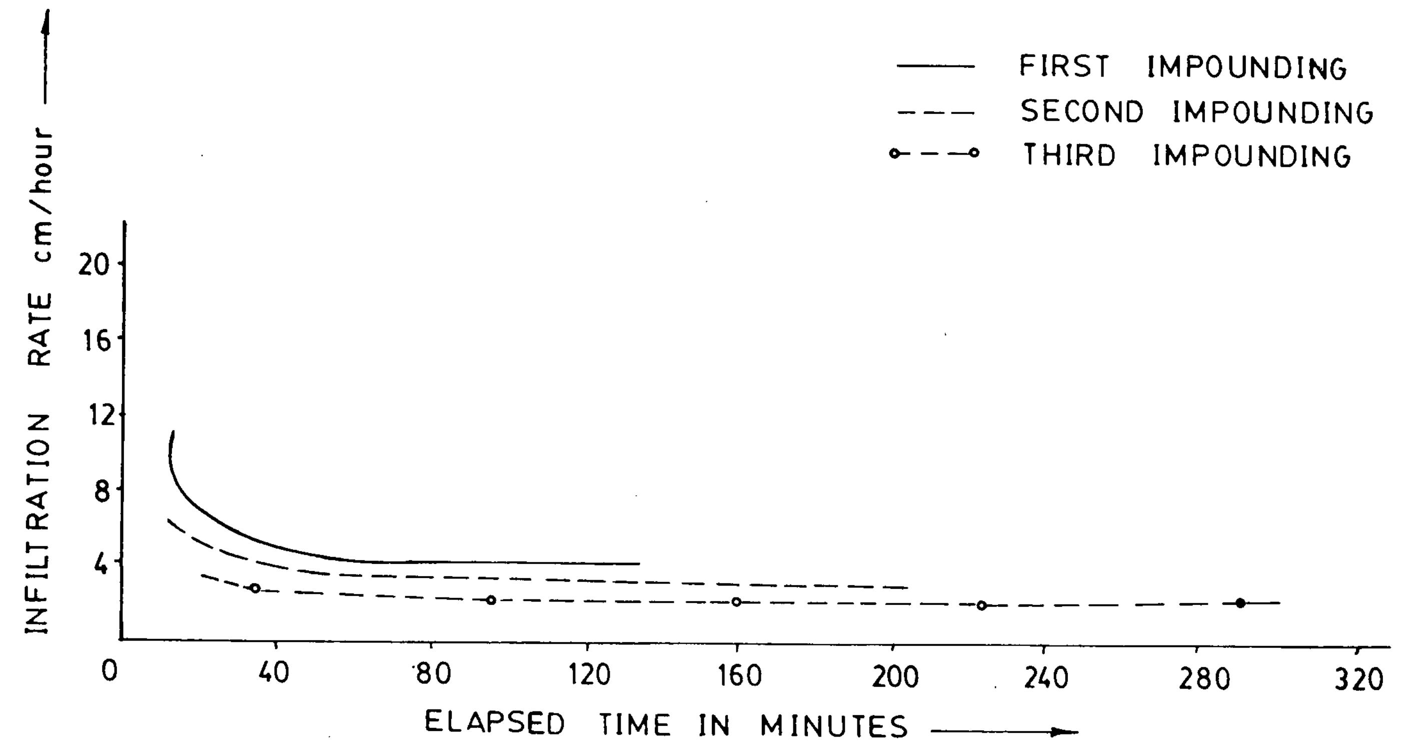


FIG-10, RELATIONSHIP OF THREE IMPOUNDINGS OF WATER AND INFILTRATION IN FIVE METER BEDWIDTH.

The rate of infiltration in the first 12 minutes was 3.8 cm per hour for the third impounding. The infiltration attained almost constant after 216 minutes at the rate of 2.75 cm per hour, until the water completely infiltrated into the soil. The total time taken for complete infiltration was 300 minutes.

4.5 Soil moisture status and number of impoundings in 2 meter bed width

Lateral and vertical soil moisture movement for each impounding of water was studied, separately. The soil samples were drawn from both the sides of the bed at the lateral distances of 0, 50 and 100 cm from the edge of the bed. At each lateral distance soil samples were collected from 0, 15, 30 and 45 cm vertical depths.

4.5.1 Soil moisture status 24 hours after one impounding

The data on the percentage soil moisture gained during hours after one impounding are presented in Table 11 and the Figures 11A and 11B. It is observed that mean moisture content at 0, 15, 30 and 45 cm depths were 13.75, 11.08 9.71 and 8.21 per cent at 0 cm lateral distance. There was a significant difference in moisture contents among the depths of 0 cm lateral distance, and there was no significant difference in moisture content among the depths at 50 cm lateral distance.

TABLE 11 : **Soil moisture status in 2 meter bed width of one impounding**

Soil moisture in percentage (one impounding)

Vertical depth in cm.	Lateral distance from the edge of the bed in cm									
	0 cm			50 cm			100 cm			Mean
	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	
0	1.10	14.85	13.75	0.72	0.74	0.02	0.90	0.90	0.00	4.59
15	4.10	15.18	11.08	4.50	4.61	0.11	4.12	4.12	0.00	3.73
30	5.90	15.61	9.71	5.42	5.42	0.00	9.61	9.61	0.00	3.24
45	6.81	15.02	8.21	7.12	7.12	0.00	8.00	8.00	0.00	2.74
Mean			10.69			0.03			0.00	3.58

Lateral distance (L) : C.D. at 5% : 0.32

Vertical distance (D) : C.D. at 5% : 0.39

Interaction (L x D) : C.D. at 5% : 0.50

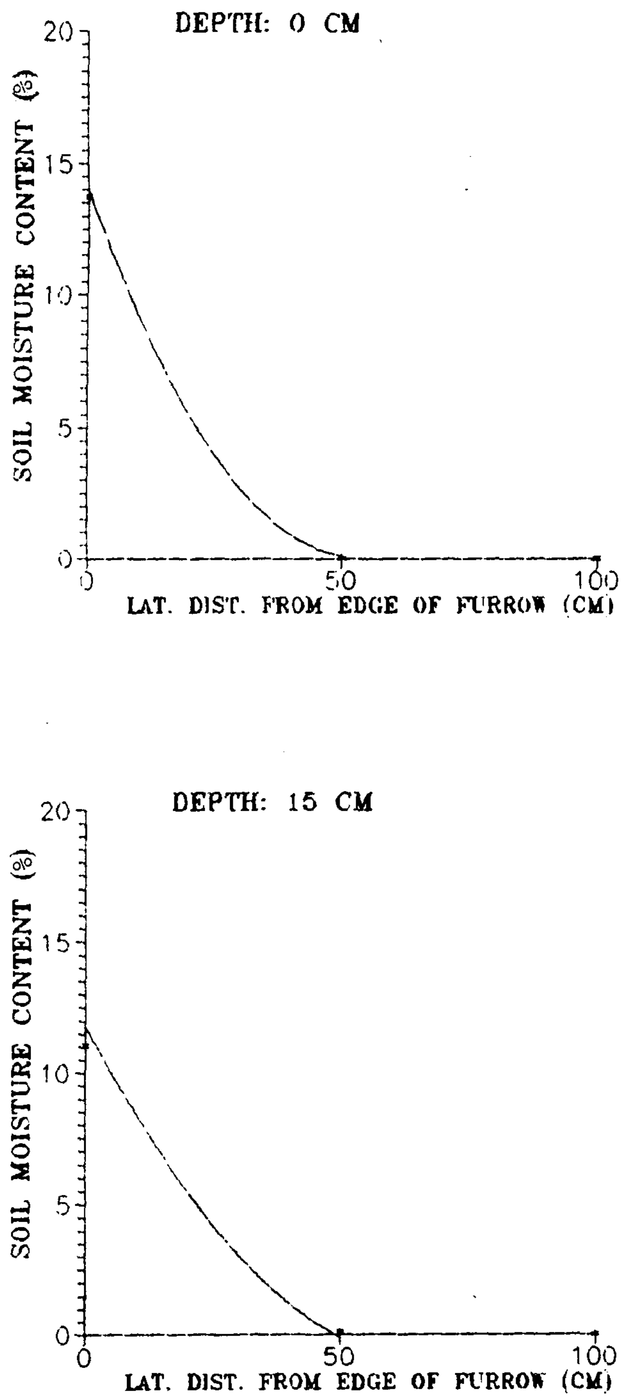
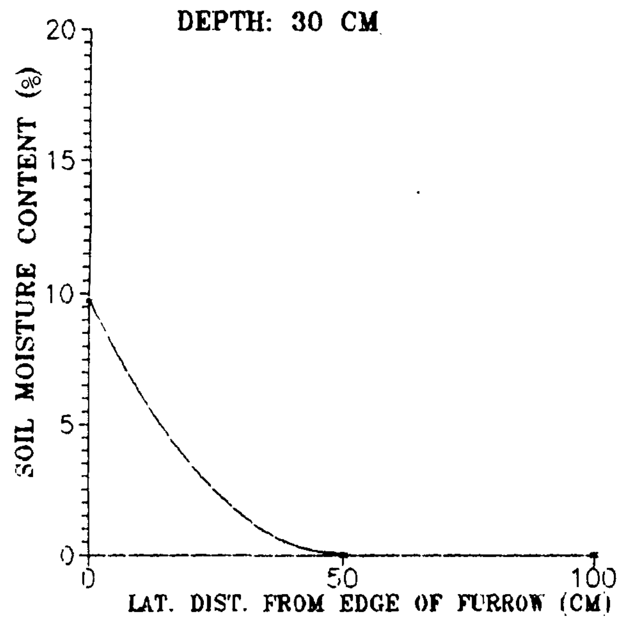


FIG. 11A: RELATIONSHIP OF ONE IMPOUNDING OF WATER AND SOIL MOISTURE STATUS AT 0 AND 15 CM DEPTH IN TWO METER BED WIDTH.



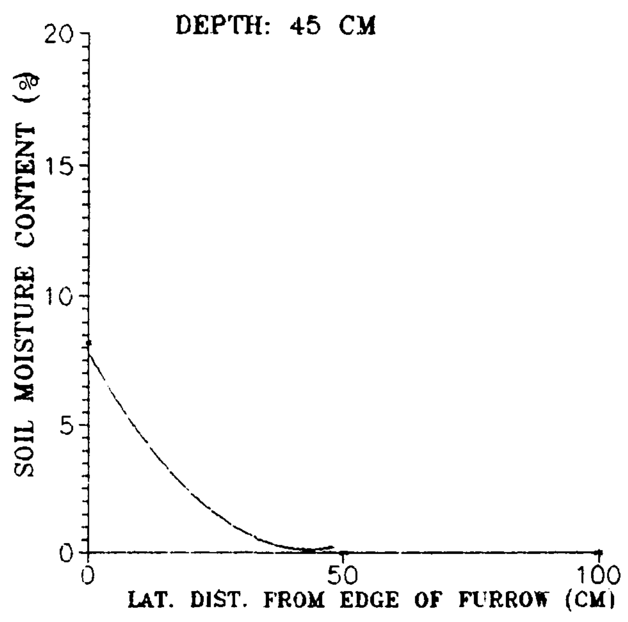


FIG. 11B: RELATIONSHIP OF ONE IMPOUNDING OF WATER AND SOIL MOISTURE STATUS AT 30 AND 45 CM DEPTH IN TWO METER BED WIDTH.

It is observed that mean moisture contents for the lateral distances of 0 and 50 cm at depths of 0, 15, 30 and 45 cm, were significantly different. There was a decrease in moisture content with increase in depth and lateral distance from the edge of the bed. There was no gain in moisture content at 0, 15, 30 and 45 cm depths of 100 cm lateral distance.

4.5.2 Soil moisture status 24 hours after two impoundings

The data on the percentage of soil moisture gained during 24 hours after two impoundings are presented in the table 12 and the figure 12A and 12B. It is observed that mean moisture content at 0, 15, 30 and 45 cm depths was 14.03 10.81 10.31 and 10.77 per cent for 0 cm lateral distance. There was a significant difference in moisture content among the depths of 0 cm lateral distance and there was no significant difference in moisture content among the depths at 50 cm lateral distance.

It is observed that mean moisture content for the lateral distances of 0 and 50 cm at a depths of 0, 15, 30 and 45 cm were significantly different. It is observed that the moisture content decreases with increase in lateral distance and depth from the edge of the furrow. There was no gain in moisture content at different depths of 100 cm lateral distance.

TABLE 12 : Soil moisture status in 2 meter bed width of two impoundings

Soil moisture in percentage (Two impoundings)

Vertical depth in cm.	Lateral distance from the edge of the bed in cm									
	0 cm			50 cm			100 cm			Mean
	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	
0	1.50	15.53	14.03	0.96	1.20	0.24	1.20	1.20	0.00	4.76
15	2.19	13.00	10.81	1.56	1.67	0.11	2.49	2.49	0.00	3.64
30	4.81	15.12	10.31	3.92	4.12	0.20	4.60	4.60	0.00	3.50
45	3.42	14.19	10.77	3.18	3.41	0.23	3.10	3.10	0.00	3.67
Mean			11.48			0.19			0.00	3.89

Lateral distance (L) : C.D. at 5% : 0.19

Vertical distance (D) : C.D. at 5% : 0.22

Interaction (L x D) : C.D. at 5% : 0.38

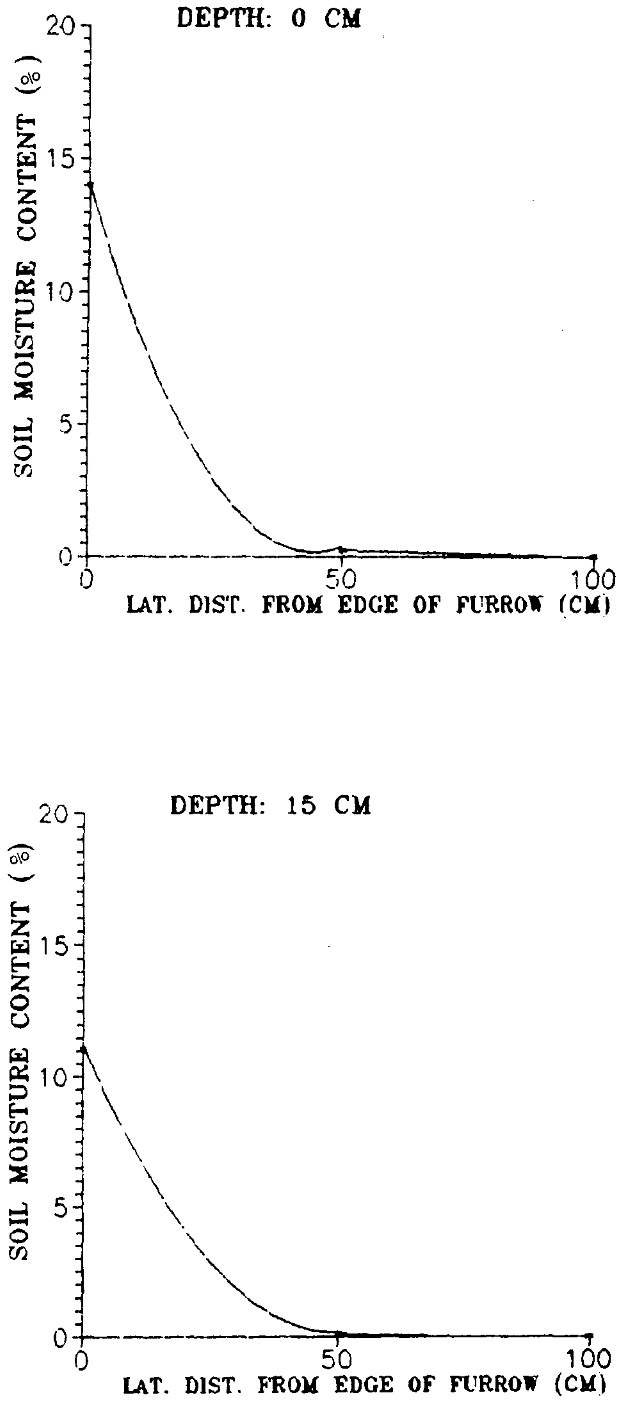


FIG. 12A: RELATIONSHIP OF TWO IMPOUNDINGS OF WATER AND SOIL MOISTURE STATUS AT 0 AND 15 CM DEPTH IN TWO METER BED WIDTH.

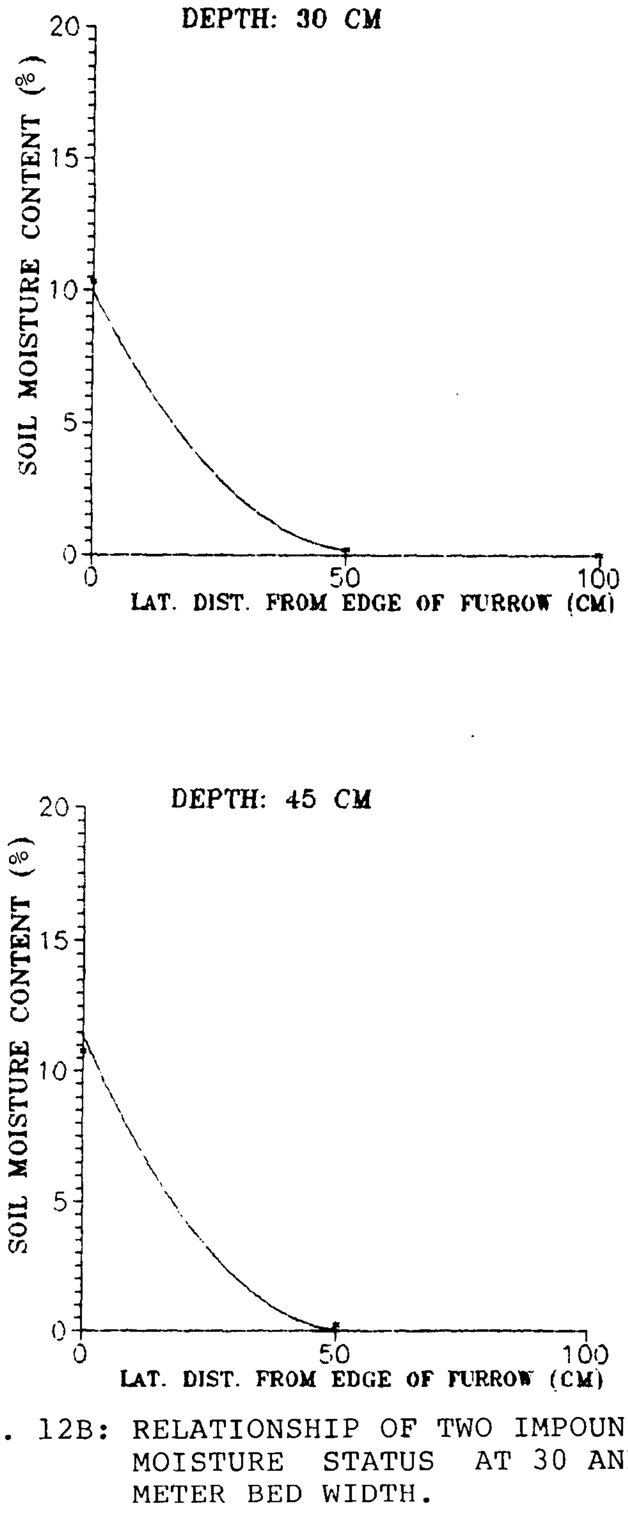


FIG. 12B: RELATIONSHIP OF TWO IMPOUNDINGS OF WATER AND SOIL MOISTURE STATUS AT 30 AND 45 CM DEPTH IN TWO METER BED WIDTH.

4.5.3 Soil moisture status 24 hours after three impoundings

The data on the percentage of soil moisture gained during 24 hours after three impoundings are presented in table 13 and Fig. 13A and 13B. It is observed that mean moisture content at 0, 15, 30 and 45 cm depths were 13.41, 12.93, 11.34 and 11.28 percent for 0 cm lateral distance. There was a significant difference in moisture content among the depths of 0 cm lateral distance. But there was no significant difference in moisture content among the depths of 50 and 100 cm lateral distances.

It is observed that mean moisture content for the lateral distance of 0, 50 cm at the depths 0, 15, 30 and 45 cm was significantly different. There was no significant difference in moisture content of 50, 100 cm lateral distance at the depths of 0, 15, 30 and 45cm. There was a decrease in moisture content with increase in depth and lateral distance from the edge of the bed.

4.6 Number of impoundings and soil moisture status in 3 meter bed width

Lateral and vertical soil moisture movement for each impounding of water was studied separately. The soil samples were drawn from both the sides of the bed at the lateral distances of 0, 50, 100 and 150 cm. At each lateral distance the soil samples were collected from 0, 15, 30 and 45 cm vertical depths.

TABLE 13 : Soil moisture status in 2 meter bed width of three impoundings

Soil moisture in percentage (Three impoundings)

Vertical depth in cm.	Lateral distance from the edge of the bed in cm									
	0 cm			50 cm			100 cm			Mean
	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	
0	1.12	14.53	13.41	0.96	0.96	0.00	1.23	1.23	0.00	4.47
15	2.19	15.12	12.93	1.56	2.85	1.29	2.41	2.67	0.26	4.82
30	3.87	15.21	11.34	3.92	5.12	1.20	4.00	4.00	0.00	4.19
45	3.42	14.70	11.28	3.18	3.25	0.07	3.21	3.21	0.00	3.78
Mean			12.24			0.64			0.07	4.31

Lateral distance (L) : C.D. at 5% : 0.40

Vertical distance (D) : C.D. at 5% : 0.47

Interaction (L x D) : C.D. at 5% : 0.81

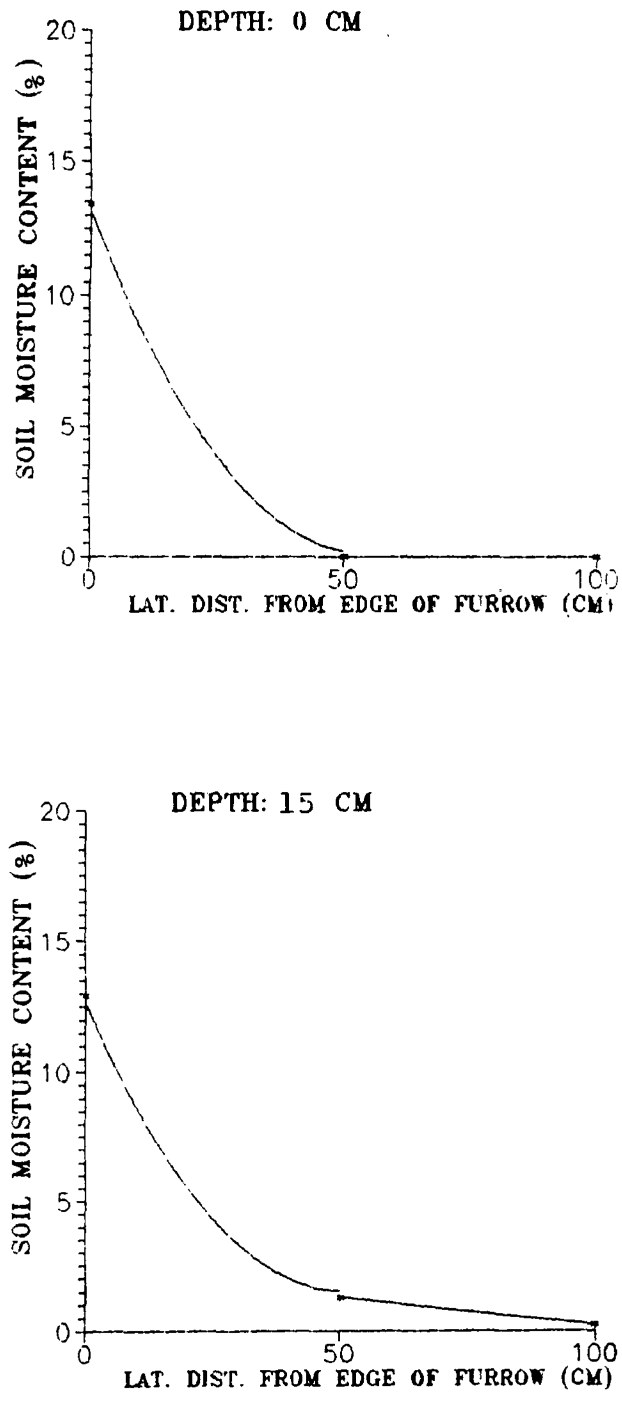
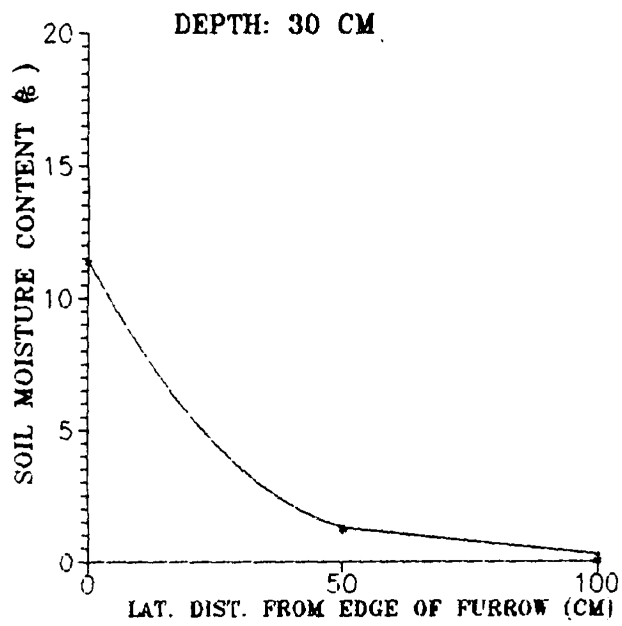


FIG. 13A: RELATIONSHIP OF THREE IMPOUNDINGS OF WATER AND SOIL MOISTURE STATUS AT 0 AND 15 CM DEPTH IN TWO METER BED WIDTH.



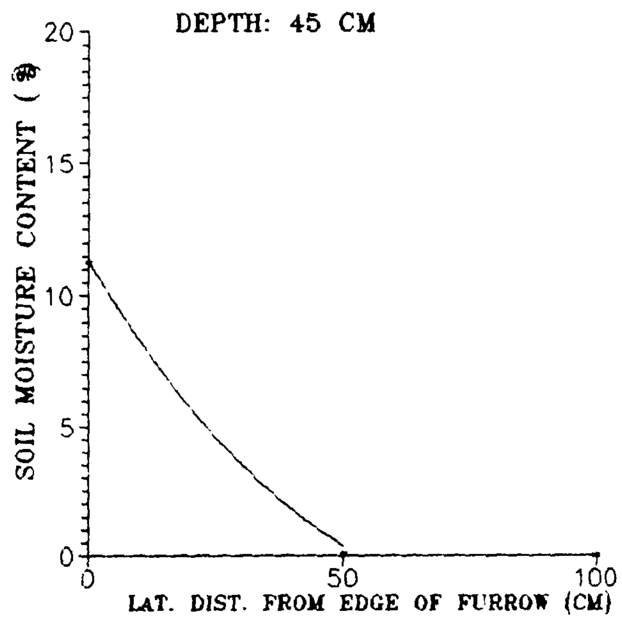


FIG. 13B: RELATIONSHIP OF THREE IMPOUNDINGS OF WATER AND SOIL MOISTURE STATUS AT 30 AND 45 CM DEPTH IN TWO METER BED WIDTH.

4.6.1 Soil moisture status 24 hours after one impounding

The data on the percentage of soil moisture gained during 24 hours after one impounding are presented in table 14 and figures 14A and 14B. It is observed that mean moisture content at 0, 15, 30 and 45 cm depths were 13.22, 10 44, 8.18 and 9.43 per cent for 0 cm lateral distance. There was a significant difference in moisture content among the depths of 0,15 and 0,30 cm at a lateral distance of 0 cm. But there was no significant difference in moisture content between the depths of 30 and 45 cm at lateral distance of 0 cm. There was no significant difference in moisture content among the depths of 50 cm lateral distance.

It is observed that mean moisture content for the lateral distance of 0, 50 cm at the depths of 0, 15, 30 and 45 cm were significantly different. There was no gain in moisture content at different depths of 100 and 150 cm lateral distance.

4.6.2 Soil moisture status 24 hours after two impoundings

The data on the percentage of soil moisture gained during 24 hours after two impoundings are presented in table 15 and figures 15A and 15B. It is observed that the differences in moisture contents among the depths of 0 cm lateral distance was significantly different. There was no significant difference in moisture content among the depths at 50 cm lateral distance.

TABLE 14 : **Soil moisture status in 3 meter bed width of one impounding**

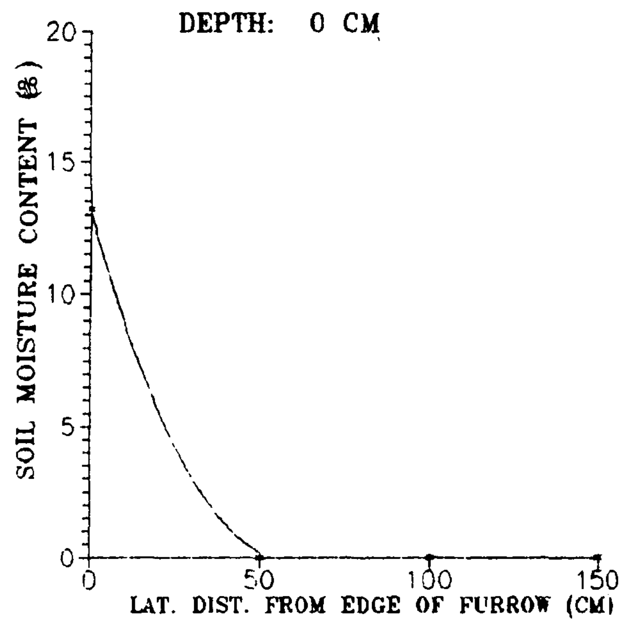
Soil moisture in percentage (one impounding)

Vertical depth in cm.	Lateral distance from the edge of the bed in cm												
	0 cm			50 cm			100 cm			150 cm			Mean
	Before impoun-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	
0	0.96	14.18	13.23	0.63	0.63	0.00	0.66	0.66	0.00	0.46	0.46	0.00	3.31
15	3.49	13.93	10.44	6.00	6.52	0.52	3.25	3.25	0.00	1.42	1.42	0.00	2.74
30	6.38	14.56	8.18	6.03	6.17	0.14	5.95	5.95	0.00	1.74	1.74	0.00	2.38
45	4.71	14.14	9.43	4.53	4.53	0.00	3.88	3.88	0.00	1.62	1.62	0.00	2.36
Mean			10.32			0.17			0.00			0.00	2.62

Lateral distance (L) : C.D. at 5% : 0.75

Vertical distance (D) : C.D. at 5% : 0.75

Interaction (L x D) : C.D. at 5% : 1.49



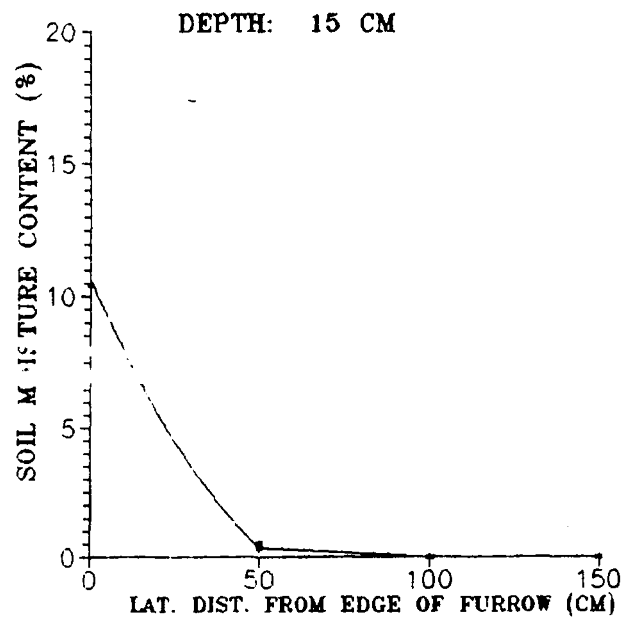


FIG. 14A: RELATIONSHIP OF ONE IMPOUNDING OF WATER AND SOIL MOISTURE STATUS AT 0 AND 15 CM DEPTH IN THREE METER BED WIDTH.

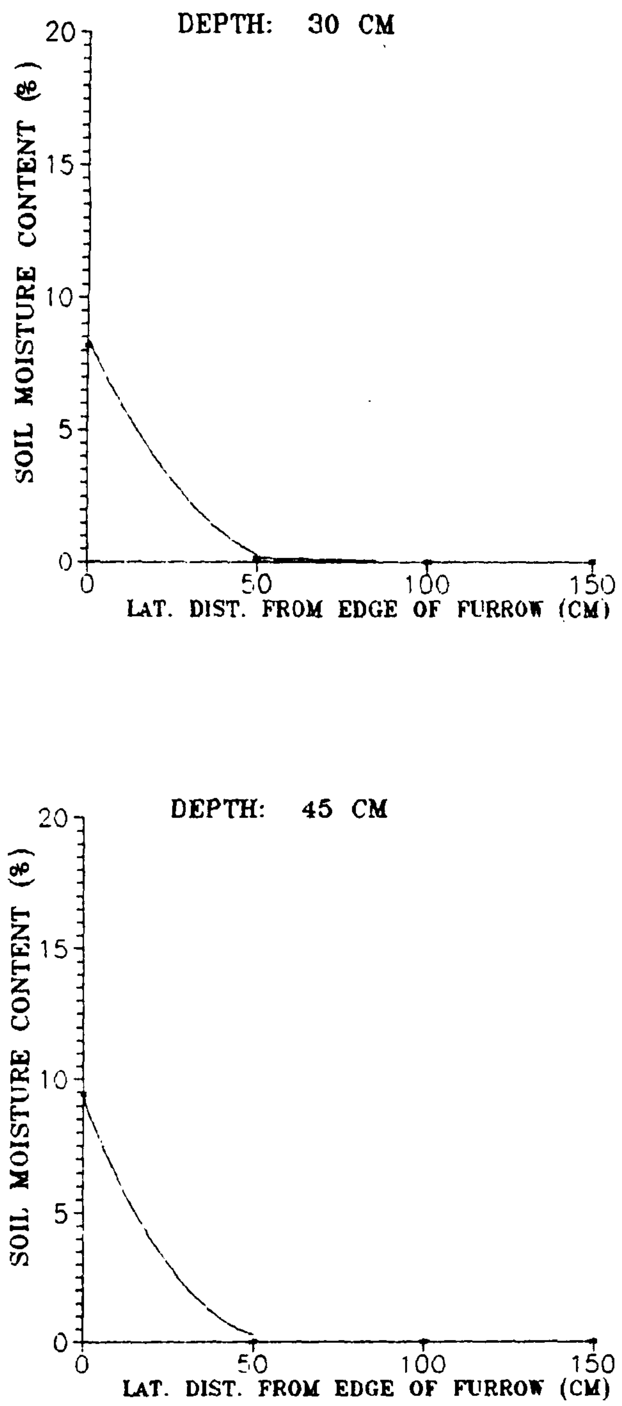


FIG. 14B: RELATIONSHIP OF ONE IMPOUNDING OF WATER AND SOIL MOISTURE STATUS AT 30 AND 45 CM DEPTH IN THREE METER BED WIDTH.

TABLE : 15 **Soil moisture status in 3 meter bed width of two impoundings**

Soil moisture in percentage (Two impoundings)

Vertical depth in cm.	Lateral distance from the edge of the bed in cm												
	0 cm			50 cm			100 cm			150 cm			Mean
	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	
0	2.50	14.12	11.62	0.29	0.29	0.00	0.28	0.28	0.00	0.29	0.29	0.00	2.91
15	5.64	15.12	9.48	5.60	6.80	1.20	7.97	8.10	0.13	5.00	5.00	0.00	2.67
30	8.29	15.18	6.89	8.30	8.91	0.61	8.76	8.76	0.00	7.89	7.89	0.00	1.88
45	7.12	15.00	7.88	8.40	9.16	0.76	8.12	8.12	0.00	8.00	8.00	0.00	2.16
Mean			8.97			0.64			0.04			0.00	2.41

Lateral distance (L) : C.D. at 5% : 0.16

Vertical distance (D) : C.D. at 5% : 0.16

Interaction (L x D) : C.D. at 5% : 0.32

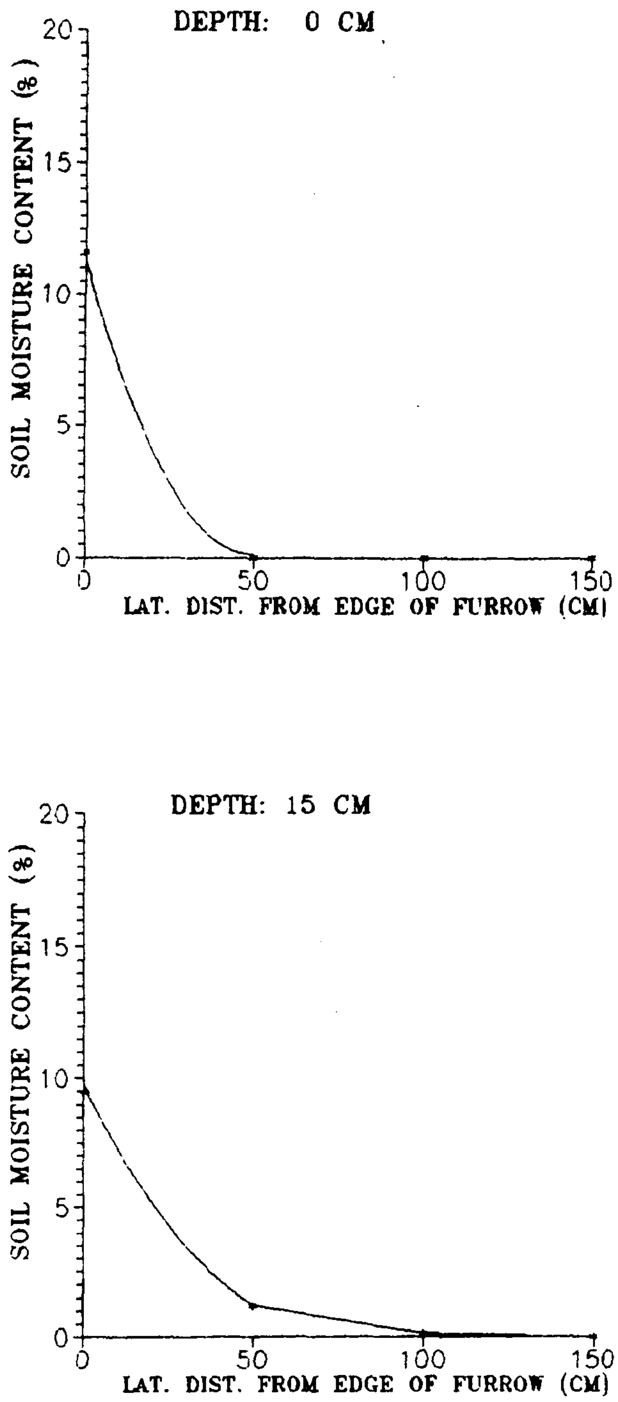


FIG. 15A: RELATIONSHIP OF TWO IMPOUNDINGS OF WATER AND SOIL MOISTURE STATUS AT 0 AND 15 CM DEPTH IN THREE METER BED WIDTH.

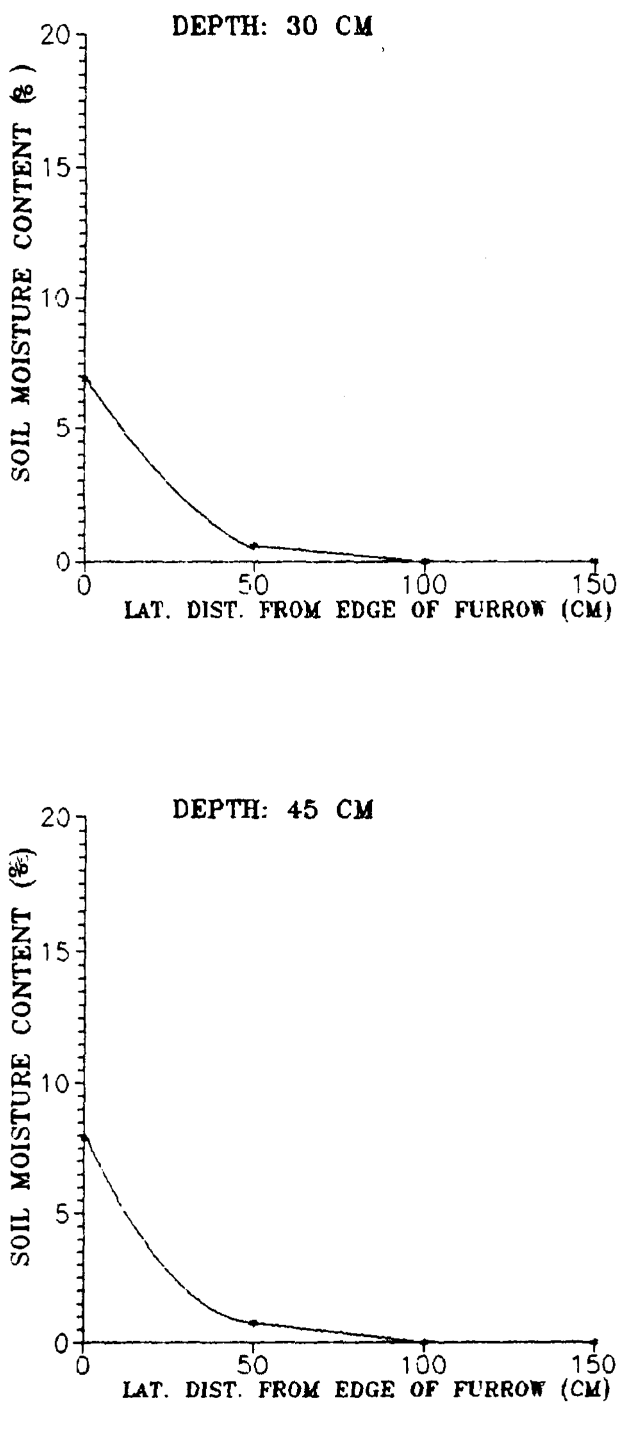


FIG. 15B: RELATIONSHIP OF TWO IMPOUNDINGS OF WATER AND SOIL MOISTURE STATUS AT 30 AND 45 CM DEPTH IN THREE METER BED WIDTH.

It is observed that mean moisture content for the lateral distances of 0 and 50 cm at the depths 0, 15, 30 and 45 cm were significantly different. There was a decrease in moisture content with increase in depth and lateral distance from the edge of the furrow. There was no gain in moisture content at different depths of 150 cm lateral distance.

4.6.3 Soil moisture status 24 hours after three impoundings

The data on the percentage of soil moisture gained during 24 hours after three impoundings are presented in table 16 and Figures 16A and 16B. It is observed that the moisture content at 0, 15, 30 and 45 cm depths of 0 cm lateral distance was significantly different. There was no significant difference in moisture content among the depths of 50, and 100 cm lateral distance.

It is observed that mean moisture content for the lateral distances of 0, 50, and 0, 100 cm was significantly different at the depths of 0, 15, 30 and 45 cm. There was a decrease in moisture content with increase in depth and lateral distance from the edge of the furrow.

4.7 Soil moisture status and number of impoundings in 4 meter bed width

Soil samples were collected separately for each impoundings at a lateral distance of 0, 50, 100, 150 and

TABLE 16 : Soil moisture status in 3 meter bed width of three impoundings

Soil moisture in percentage (Three impoundings)

Vertical depth in cm.	Lateral distance from the edge of the bed in cm												
	0 cm			50 cm			100 cm			150 cm			Mean
	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	
0	0.66	15.18	14.52	0.64	1.23	0.59	0.65	0.65	0.00	0.50	0.50	0.00	3.78
15	5.56	15.12	9.56	3.88	4.92	1.04	5.56	6.12	0.62	5.19	5.19	0.00	2.55
30	6.72	15.62	8.90	4.92	5.71	0.79	9.50	9.72	0.22	8.12	8.12	0.00	2.48
45	7.51	15.18	7.67	5.12	5.61	0.49	7.12	7.12	0.00	7.12	7.12	0.00	2.34
Mean			10.16			0.73			0.21			0.00	2.74

Lateral distance (L) : C.D. at 5% : 0.46

Vertical distance (D) : C.D. at 5% : 0.46

Interaction (L x D) : C.D. at 5% : 0.92

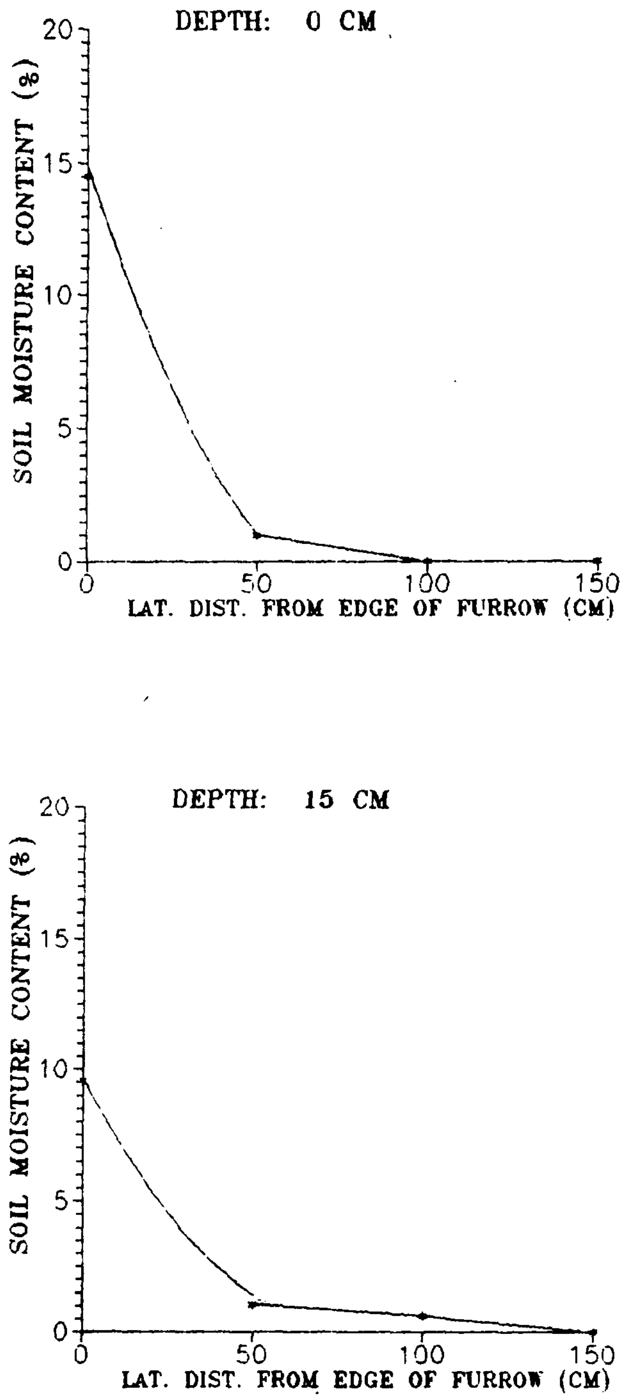
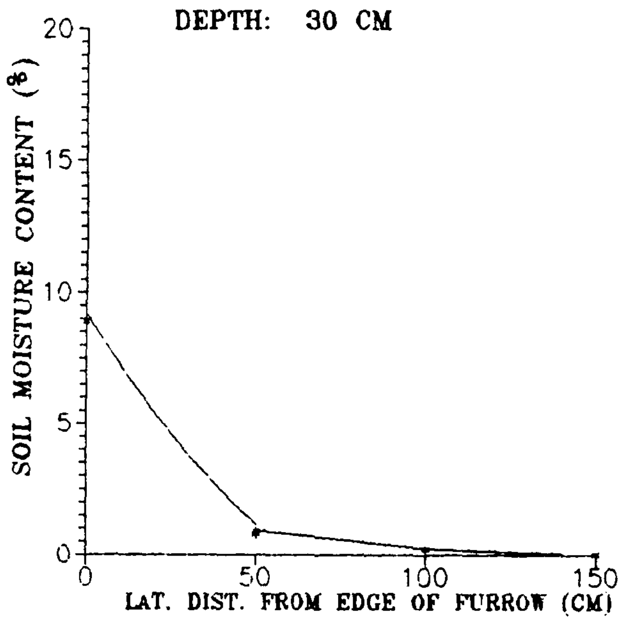


FIG. 16A: RELATIONSHIP OF THREE IMPOUNDINGS OF WATER AND SOIL MOISTURE STATUS AT 0 AND 15 CM DEPTH IN THREE METER BED WIDTH.



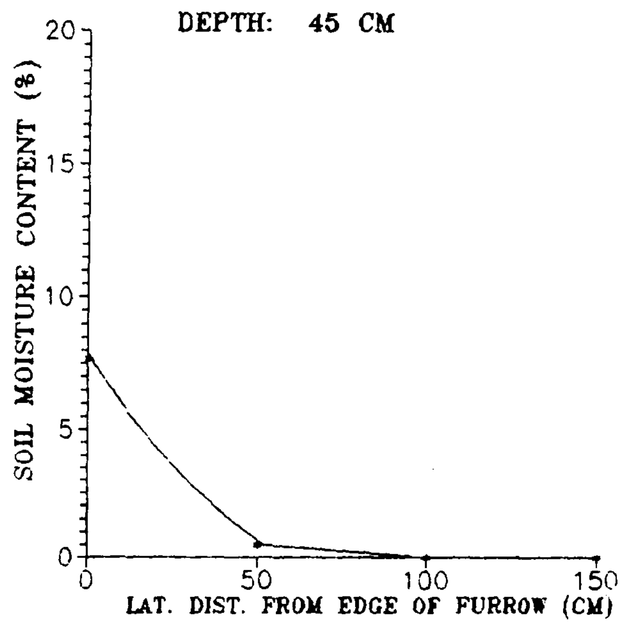


FIG. 16B: RELATIONSHIP OF THREE IMPOUNDINGS OF WATER AND SOIL MOISTURE STATUS AT 30 AND 45 CM DEPTH IN THREE METER BED WIDTH.

200 cm. At each lateral distance the soil samples were collected from 0, 15, 30 and 45 cm vertical depth.

4.7.1 Soil moisture status 24 hours after one impounding

The data on the percentage of soil moisture gained during 24 hours after one impounding are presented in table 17 and figure 17A and 17B. It is observed that moisture content at 0, 15, 30 and 45 cm depths of 0 cm lateral distance were significantly different. There was no increase in moisture content at 0, 30 and 45 cm depths of 50 cm lateral distance.

It is observed that mean moisture content for the lateral distance of 0 and 50 cm was significantly different at a depths of 0, 15, 30 and 45 cm. There was no gain in moisture content at different depths of 100, 150 and 200 cm lateral distance.

4.7.2 Soil moisture status 24 hours after two impoundings

The data on the percentage of soil moisture gained during 24 hours after two impoundings are presented in table 18 and figures 18A and 18B. It is observed that mean moisture content at 0, 15, 30 and 45 cm depths of 0 cm lateral distance was significantly different. There was no significant difference in moisture content among the depths of 50 cm lateral distance.

TABLE 17 : Soil moisture status in 4 meter bed width of one impounding

Soil moisture in percentage (one impounding)

Vertical depth in cm.	Lateral distance from the edge of the bed in cm															
	0 cm			50 cm			100 cm			150 cm			200 cm			Mean
	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	
0	0.92	15.12	14.20	0.60	0.60	0.00	0.98	0.98	0.00	0.75	0.75	0.00	0.78	0.78	0.00	2.84
15	9.85	15.25	5.40	6.16	6.71	0.55	9.70	9.70	0.00	10.60	10.60	0.00	9.00	9.00	0.00	1.19
30	8.57	15.62	7.05	6.39	6.93	0.00	9.33	9.33	0.00	8.00	8.00	0.00	8.91	8.91	0.00	1.41
45	7.12	14.96	7.84	7.27	7.27	0.00	5.40	5.40	0.00	5.83	5.83	0.00	8.31	8.31	0.00	1.57
Mean			8.62			0.14			0.00			0.00			0.00	1.75

Lateral distance (L) : C.D. at 5% : 0.23

Vertical distance (D) : C.D. at 5% : 0.20

Interaction (L x D) : C.D. at 5% : 0.45

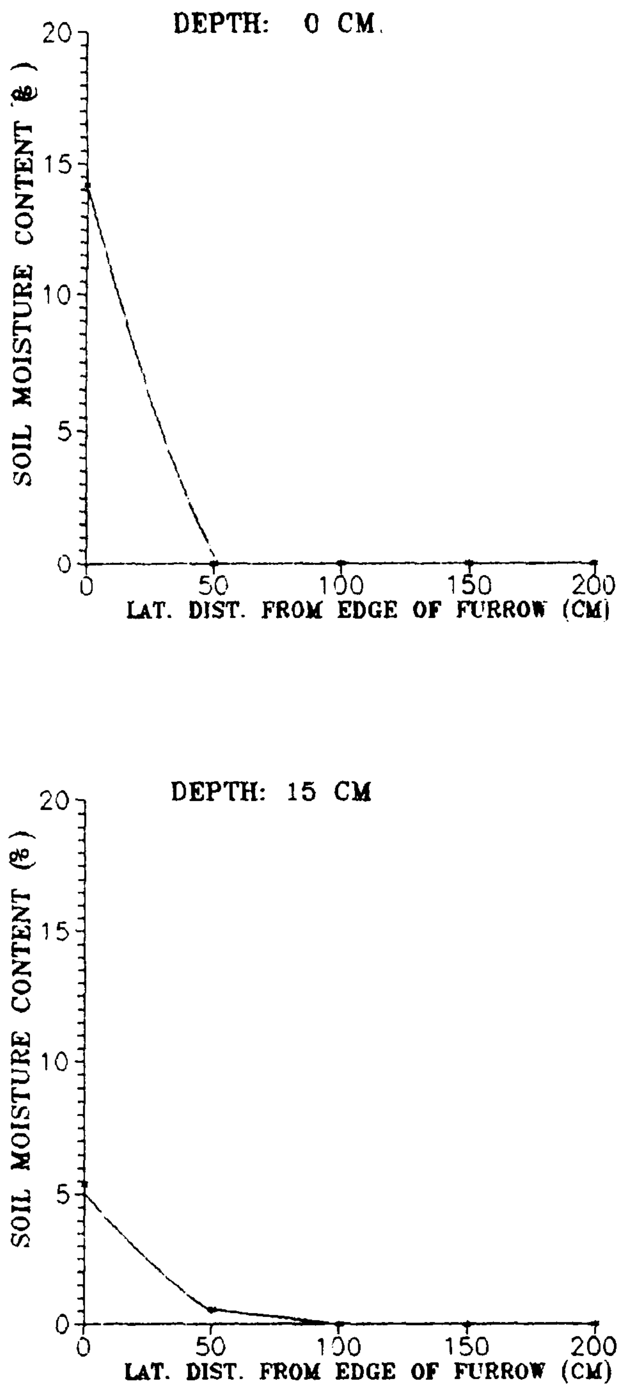
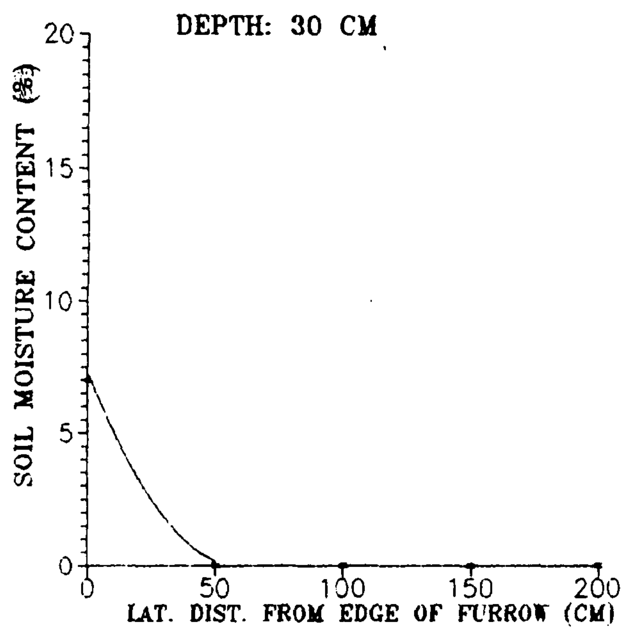


FIG. 17A: RELATIONSHIP OF ONE IMPOUNDING OF WATER AND SOIL MOISTURE STATUS AT 0 AND 15 CM DEPTH IN FOUR METER BED WIDTH.



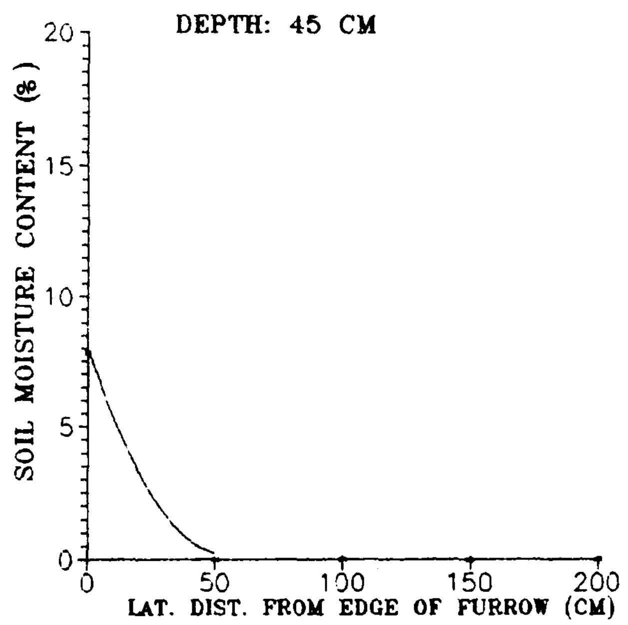


FIG. 17B: RELATIONSHIP OF ONE IMPOUNDING OF WATER AND SOIL MOISTURE STATUS AT 30 AND 45 CM DEPTH IN FOUR METER BED WIDTH.

TABLE 18 : Soil moisture status in 4 meter bed width of two impoundings

Soil moisture in percentage (Two impoundings)

Vertical depth in cm.	Lateral distance from the edge of the bed in cm															
	0 cm			50 cm			100 cm			150 cm			200 cm			Mean
	Before impoon-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	
0	0.80	14.14	13.34	0.72	1.52	0.80	0.71	0.71	0.00	0.90	0.90	0.00	1.00	1.00	0.00	2.83
15	8.13	15.35	7.22	5.06	6.20	1.14	6.17	7.00	0.83	4.16	4.16	0.00	6.10	6.10	0.00	1.84
30	8.00	14.98	6.98	6.95	7.98	1.03	5.60	6.35	0.75	5.10	5.10	0.00	5.91	5.91	0.00	1.75
45	6.26	14.70	8.44	5.81	6.12	0.31	5.60	5.60	0.00	4.50	4.50	0.00	4.81	4.81	0.00	1.81
Mean			9.00			0.82			0.40			0.00			0.00	2.05

Lateral distance (L) : C.D. at 5% : 0.08

Vertical distance (D) : C.D. at 5% : 0.07

Interaction (L x D) : C.D. at 5% : 0.16

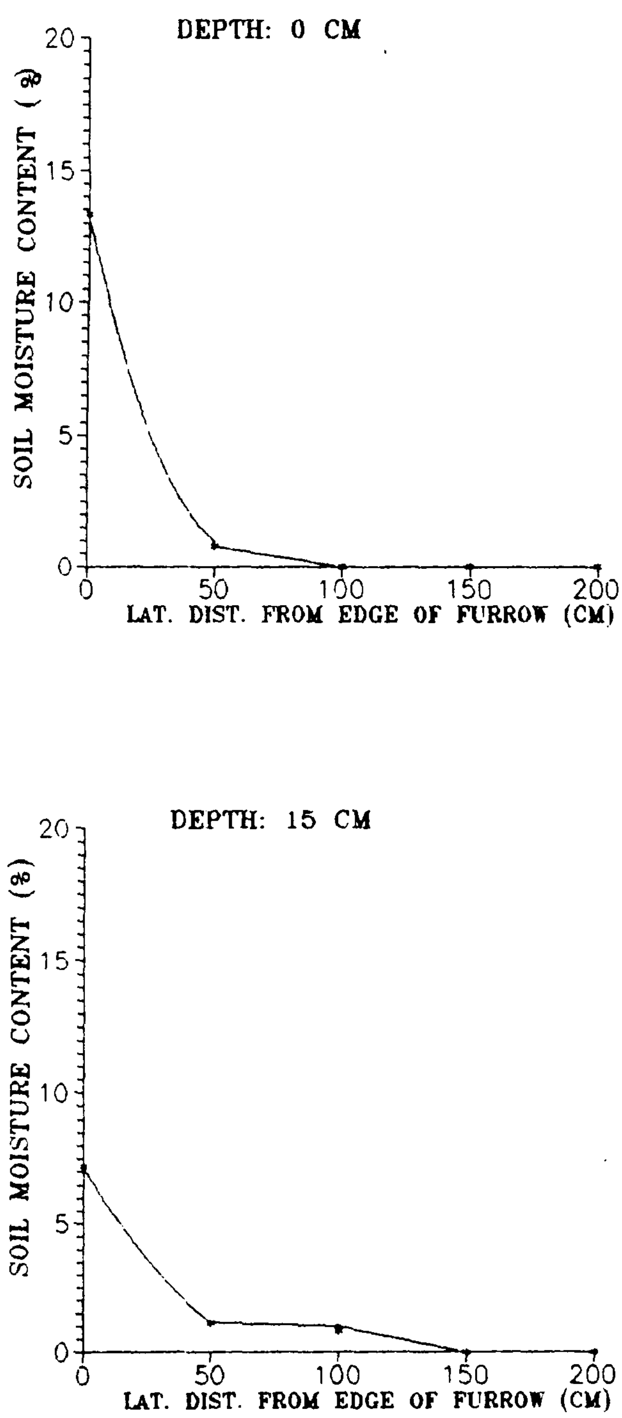


FIG. 18A: RELATIONSHIP OF TWO IMPOUNDINGS OF WATER AND SOIL MOISTURE STATUS AT 0 AND 15 CM DEPTH IN FOUR METER BED WIDTH.

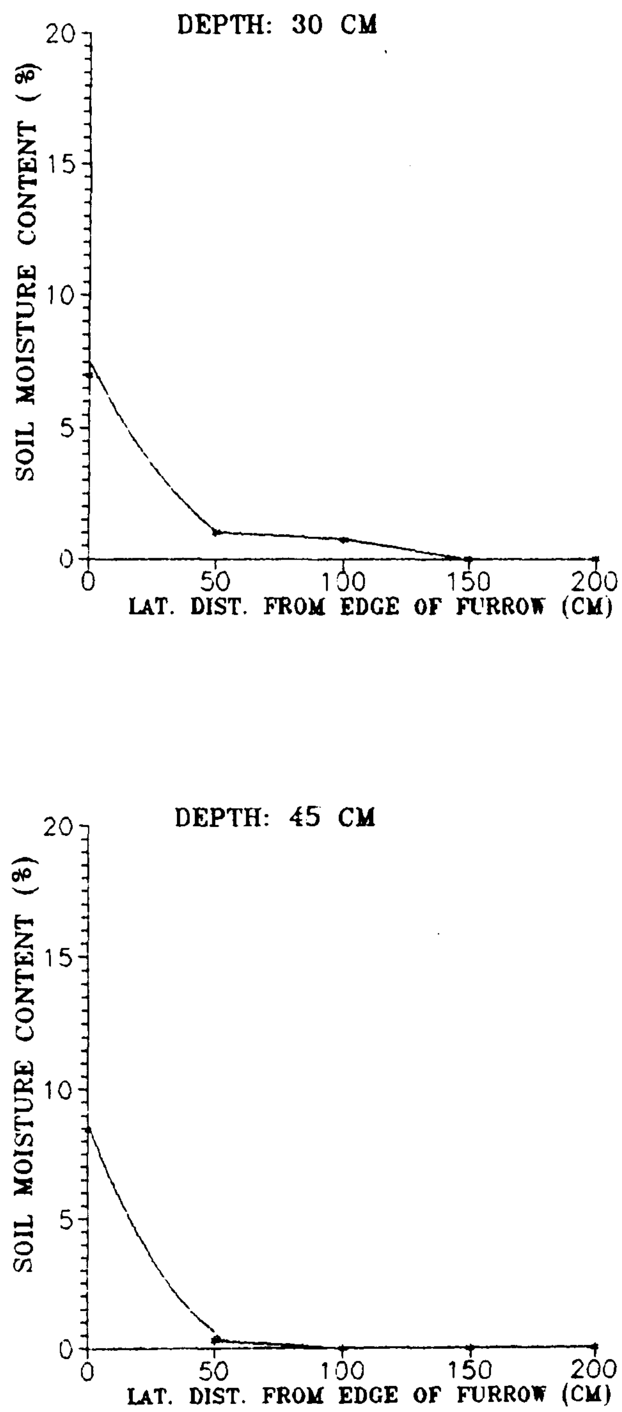


FIG. 18B: RELATIONSHIP OF TWO IMPOUNDINGS OF WATER AND SOIL MOISTURE STATUS AT 30 AND 45 CM DEPTH IN FOUR METER BED WIDTH.

It is observed that mean moisture content for the lateral distance of 0 and 50 cm at a depths 0, 15, 30 and 45 cm were significantly different. There was no gain in moisture content at different depths of 150 and 200 cm lateral distances.

4.7.3 Soil moisture status 24 hours after three impoundings

The data on the percentage of soil moisture gained during 24 hours after three impoundings are presented in table 19 and figures 19A and 19B. It is observed that mean moisture content at 0,15 and 45 cm depths of 0 cm lateral distance were significantly different. But there was no significant different in moisture content between 15 and 30 cm depths, and also there was no significant difference in moisture content among the depths of 50 and 100 cm lateral distance.

It is observed that mean moisture content for the lateral distances of 0, 50 and 0, 100 cm at the depths of 0, 15, 30 and 45 cm were significantly different. There was no gain in moisture content at different depths of 200 cm lateral distance.

4.8 Soil moisture status and number of impoundings in 5 meter bed width

Soil samples were collected separately for each impounding at the lateral distances of 0, 50, 100, 150, 200

TABLE 19 : Soil moisture status in 4 meter bed width of three impoundings

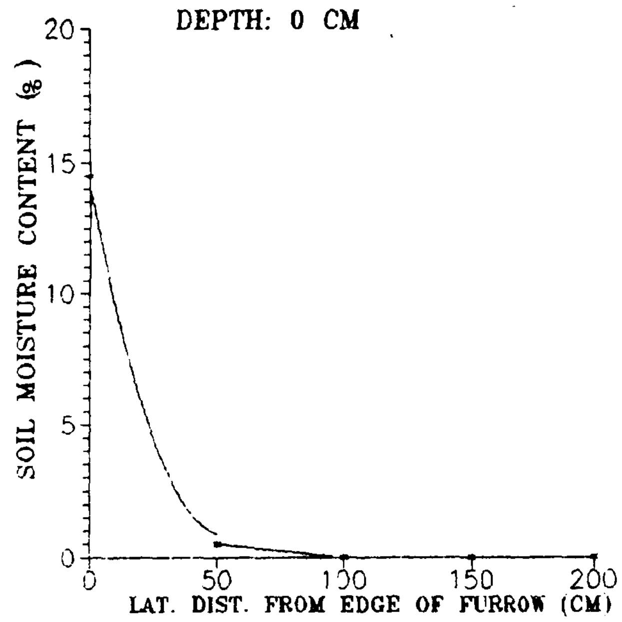
Soil moisture in percentage (Three impoundings)

Vertical depth in cm.	Lateral distance from the edge of the bed in cm															Mean
	0 cm			50 cm			100 cm			150 cm			200 cm			
	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	
0	1.02	15.12	14.10	0.98	1.41	0.43	1.12	1.12	0.00	0.71	0.71	0.00	1.00	1.00	0.00	2.91
15	4.80	15.81	11.07	4.12	6.52	2.40	3.95	4.93	0.98	4.16	4.38	0.22	4.10	4.10	0.00	2.93
30	4.45	15.12	10.67	5.34	7.72	2.38	5.11	5.81	0.70	5.20	5.20	0.00	4.68	4.68	0.00	2.75
45	3.52	14.96	11.44	4.92	6.01	1.09	4.31	4.31	0.00	4.11	4.11	0.00	4.69	4.69	0.00	2.51
Mean			11.82			1.58			0.42			0.06			0.00	2.78

Lateral distance (L) : C.D. at 5% : 0.31

Vertical distance (D) : C.D. at 5% : 0.27

Interaction (L x D) : C.D. at 5% : 0.62



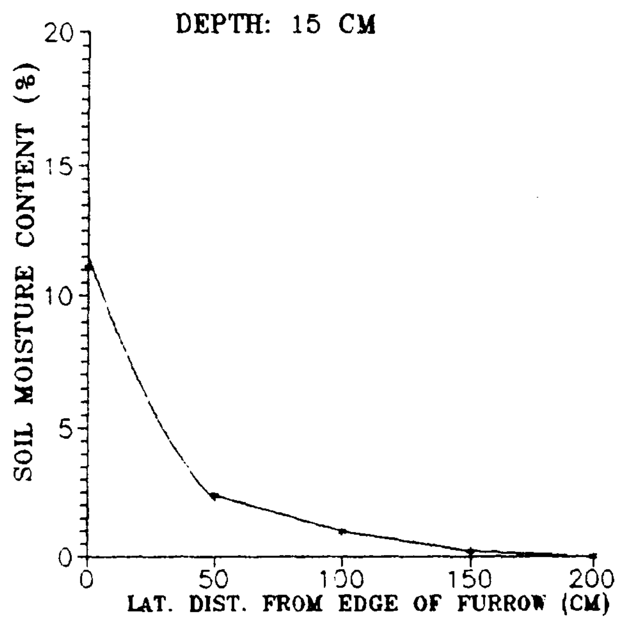
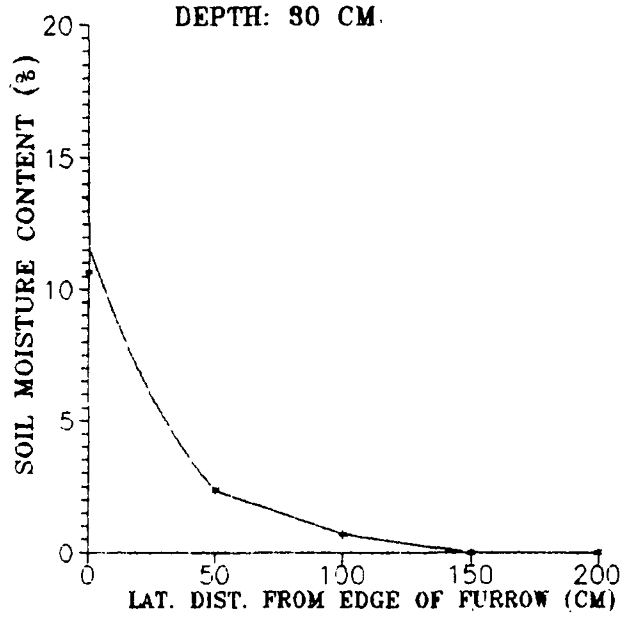


FIG. 19A: RELATIONSHIP OF THREE IMPOUNDINGS OF WATER AND SOIL MOISTURE STATUS AT 0 AND 15 CM DEPTH IN FOUR METER BED WIDTH.



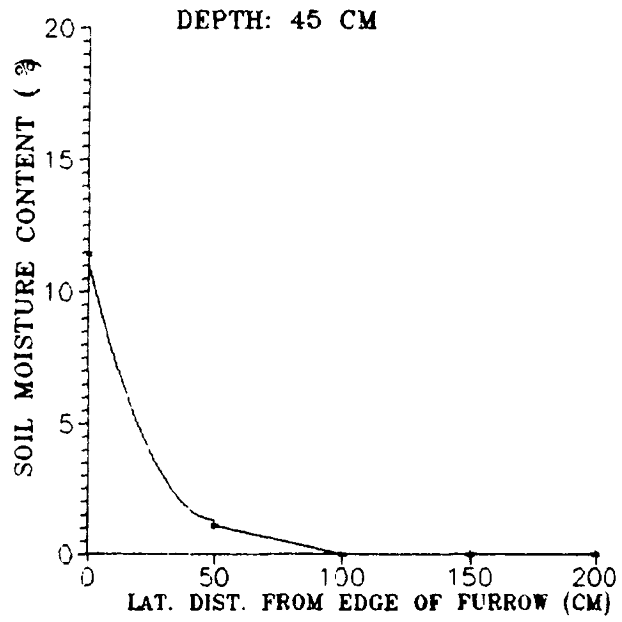


FIG. 19B: RELATIONSHIP OF THREE IMPOUNDINGS OF WATER AND SOIL MOISTURE STATUS AT 30 AND 45 CM DEPTH IN FOUR METER BED WIDTH.

and 250 cm. At each lateral distance the soil samples were collected from 0, 15, 30 and 45 cm vertical depths.

4.8.1 <u>Soil moisture status 24 hours after one impounding</u>

The data on the percentage are presented in Table 20 and Figures 20A and 20B. It is observed that the mean moisture content at 0, 15, 30 and 45 cm depths were 13.33, 6.55, 6.01 and 3.61 per cent for 0 cm lateral distance. There was no moisture gain at 0, 15, 30 and 45 cm depths of 50, 100 150, 200 and 250 cm lateral distances, but there was an increase in moisture content at 30 cm depth of 50 cm lateral distance.

4.8.2 <u>Soil moisture status 24 hours after two impoundings</u>

The data on the percentage of soil moisture gained during 24 hours after two impoundings are presented in table 21 and Figures 21a and 21b. It is observed that mean moisture content at 0, 15. 30 and 45 cm depths of 0 cm lateral distance were significantly different. There was a significant difference in moisture content between 15 and 30 cm depths at 50 cm lateral distance. There was no moisture gain at different depths of 150, 200 and 250 cm lateral distances.

4.8.3 <u>Soil moisture status 24 hours after three impoundings</u>

The data on the percentage of soil moisture gained during 24 hours after three impoundings are presented in Table 22 and Figures 22A and 22B. It is observed that mean moisture content at 0, 15, 30 and 45 cm depths of 0 cm

TABLE 20 : Soil moisture status in 5 meter bed width of one impounding

Soil moisture in percentage (one impounding)

Vertical depth in cm.	Lateral distance from the edge of the bed in cm																		Mean
	0 cm			50 cm			100 cm			150 cm			200 cm			250 cm			
	Before impoun-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	
0	1.20	14.50	13.33	1.00	1.00	0.00	1.12	1.12	0.00	1.00	1.00	0.00	0.83	0.83	0.00	1.15	1.15	0.00	2.22
15	7.96	14.51	6.55	6.26	6.26	0.00	4.95	4.95	0.00	4.02	4.02	0.00	3.12	3.12	0.00	4.00	4.00	0.00	1.09
30	8.00	14.81	6.01	7.40	7.81	0.41	3.13	3.13	0.00	4.95	4.95	0.00	4.50	4.50	0.00	3.12	3.12	0.00	1.07
45	11.20	14.81	3.61	8.18	8.18	0.00	4.68	4.68	0.00	4.08	4.08	0.00	5.39	5.39	0.00	3.11	3.11	0.00	0.60
Mean			7.38			0.10			0.00			0.00			0.00				1.25

Lateral distance (L) : C.D. at 5% : 0.20

Vertical distance (D) : C.D. at 5% : 0.16

Interaction (L x D) : C.D. at 5% : 0.28

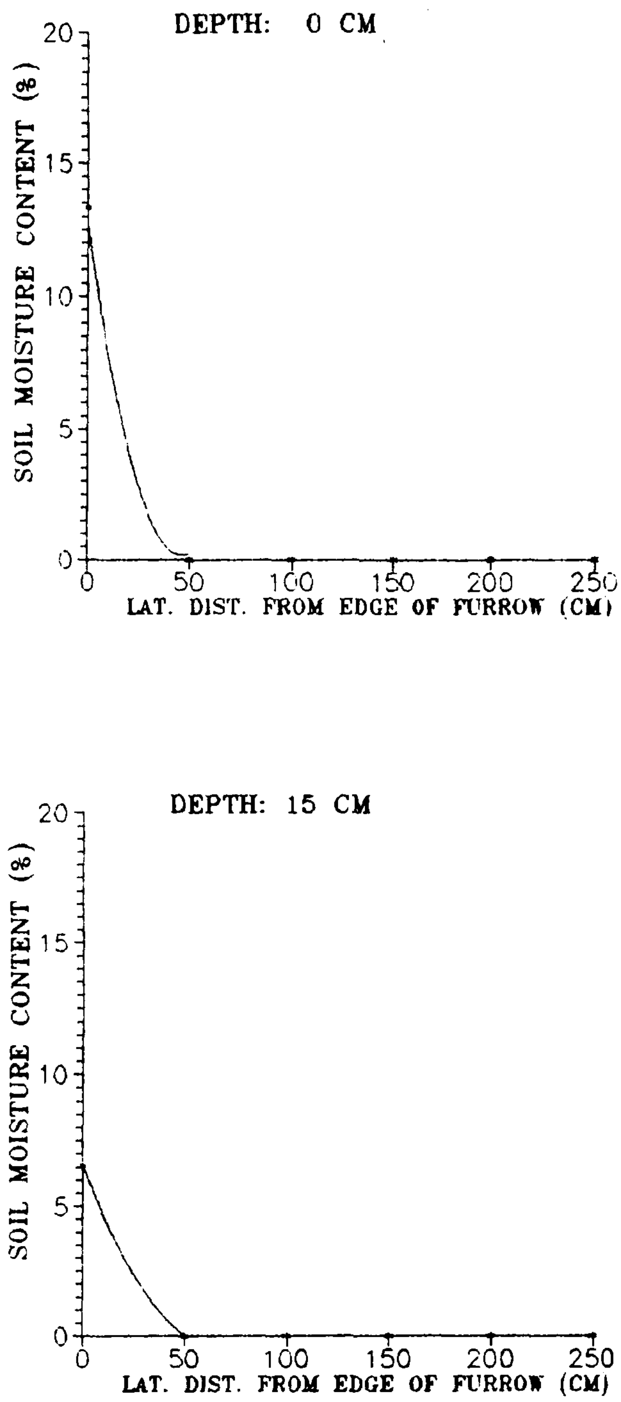
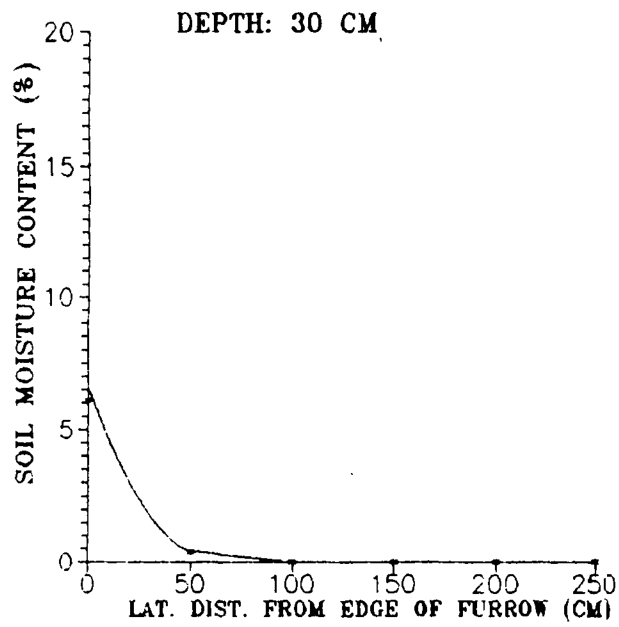


FIG. 20A: RELATIONSHIP OF ONE IMPOUNDING OF WATER AND SOIL MOISTURE STATUS AT 0 AND 15 CM DEPTH IN FIVE METER BED WIDTH.



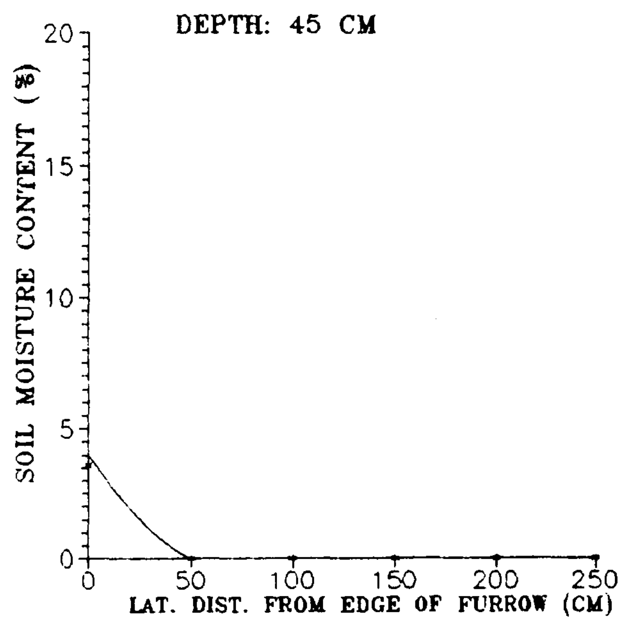


FIG. 20B: RELATIONSHIP OF ONE IMPOUNDING OF WATER AND SOIL MOISTURE STATUS AT 30 AND 45 CM DEPTH IN FIVE METER BED WIDTH.

TABLE 21 : Soil moisture status in 5 meter bed width of two impoundings

Soil moisture in percentage (Two impoundings)

Vertical depth in cm.	Lateral distance from the edge of the bed in cm: 0 cm			50 cm			100 cm			150 cm			200 cm			250 cm			Mean
	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	Before impounding	After impounding	Moisture gained	
0	1.15	14.16	13.01	0.60	0.60	0.00	0.50	0.50	0.00	0.90	0.90	0.00	0.60	0.60	0.00	0.12	0.12	0.00	2.17
15	6.17	15.12	9.35	4.70	5.52	0.82	4.45	4.97	0.52	3.12	3.12	0.00	3.54	3.54	0.00	2.12	2.12	0.00	1.78
30	7.97	14.50	6.53	6.25	7.38	1.13	6.40	6.40	0.00	3.60	3.60	0.00	4.00	4.00	0.00	2.50	2.50	0.00	1.28
45	9.78	14.50	4.72	7.58	7.62	0.04	5.81	5.81	0.00	3.60	3.60	0.00	3.52	3.52	0.00	2.50	2.50	0.00	0.79
Mean			8.40			0.50			0.13			0.00			0.00				1.51

Lateral distance (L) : C.D. at 5% : 0.17

Vertical distance (D) : C.D. at 5% : 0.13

Interaction (L x D) : C.D. at 5% : 0.26

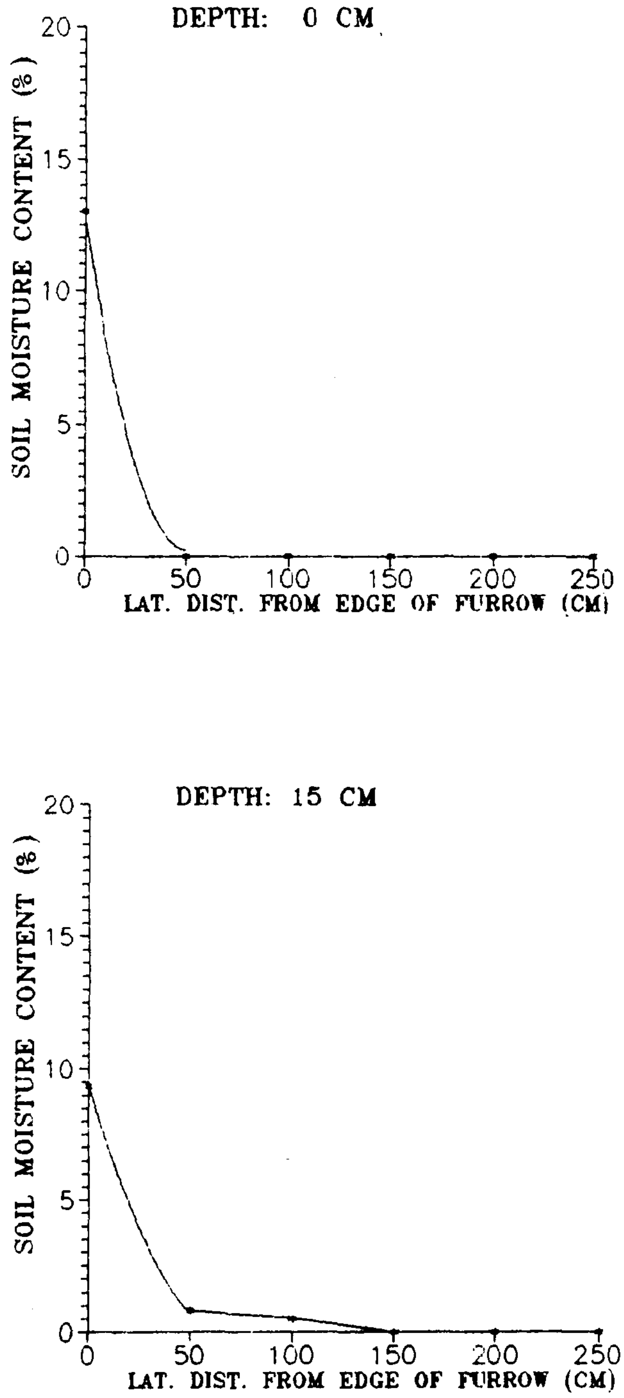


FIG. 21A: RELATIONSHIP OF TWO IMPOUNDINGS OF WATER AND SOIL MOISTURE STATUS AT 0 AND 15 CM DEPTH IN FIVE METER BED WIDTH.

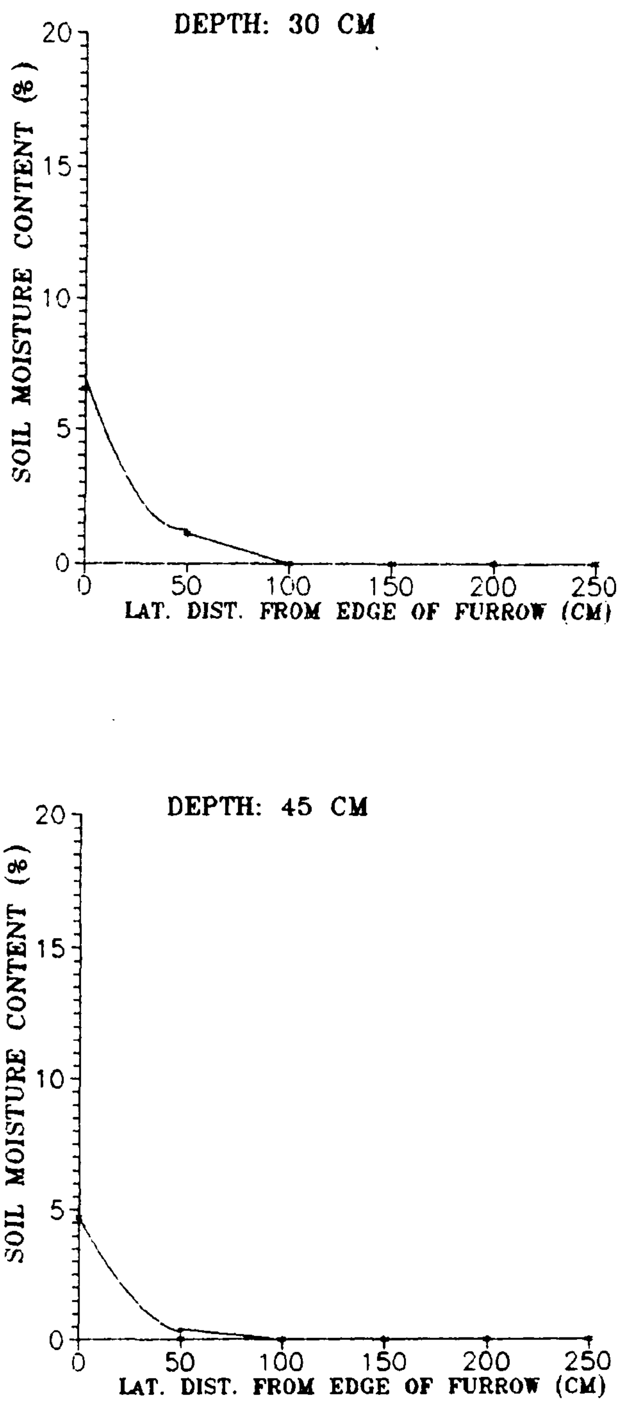


FIG. 21B: RELATIONSHIP OF TWO IMPOUNDINGS OF WATER AND SOIL MOISTURE STATUS AT 30 AND 45 CM DEPTH IN FIVE METER BED WIDTH.

TABLE 22 : Soil moisture status in 5 meter bed width of three impoundings

Soil moisture in percentage (Three impoundings)

Vertical depth in cm.	Lateral distance from the edge of the bed in cm																		
	0 cm			50 cm			100 cm			150 cm			200 cm			250 cm			Mean
	Before impoun-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	Before impoun-ding	After impoun-ding	Moisture gained	
0	0.90	15.12	14.22	0.81	1.02	0.21	0.98	0.98	0.00	0.61	0.61	0.00	0.79	0.79	0.00	0.84	0.84	0.00	2.41
15	4.29	15.50	11.21	3.72	5.12	1.40	5.12	6.70	1.18	3.12	3.86	0.74	4.00	4.00	0.00	3.12	3.12	0.00	2.42
30	6.00	15.67	9.67	4.12	5.68	1.56	5.13	5.61	0.48	4.31	4.31	0.00	4.81	4.81	0.00	3.50	3.50	0.00	1.95
45	5.71	15.00	9.29	4.98	5.62	0.64	5.13	5.55	0.42	3.52	3.52	0.00	4.12	4.12	0.00	4.10	4.10	0.00	1.73
Mean			10.35			0.95			0.52			0.19			0.00				2.08

Lateral distance (L) : C.D. at 5% : 0.12

Vertical distance (D) : C.D. at 5% : 0.11

Interaction (L x D) : C.D. at 5% : 0.26

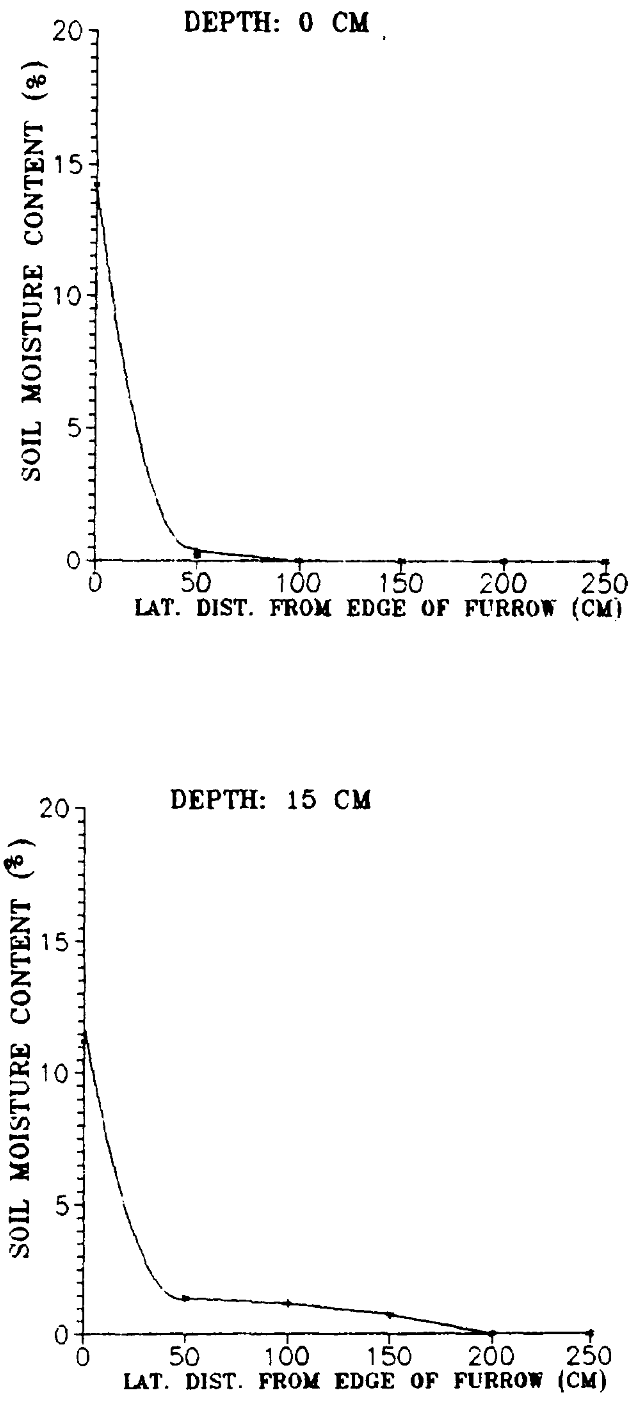


FIG. 22A: RELATIONSHIP OF THREE IMPOUNDINGS OF WATER AND SOIL MOISTURE STATUS AT 0 AND 15 CM DEPTH IN FIVE METER BED WIDTH.

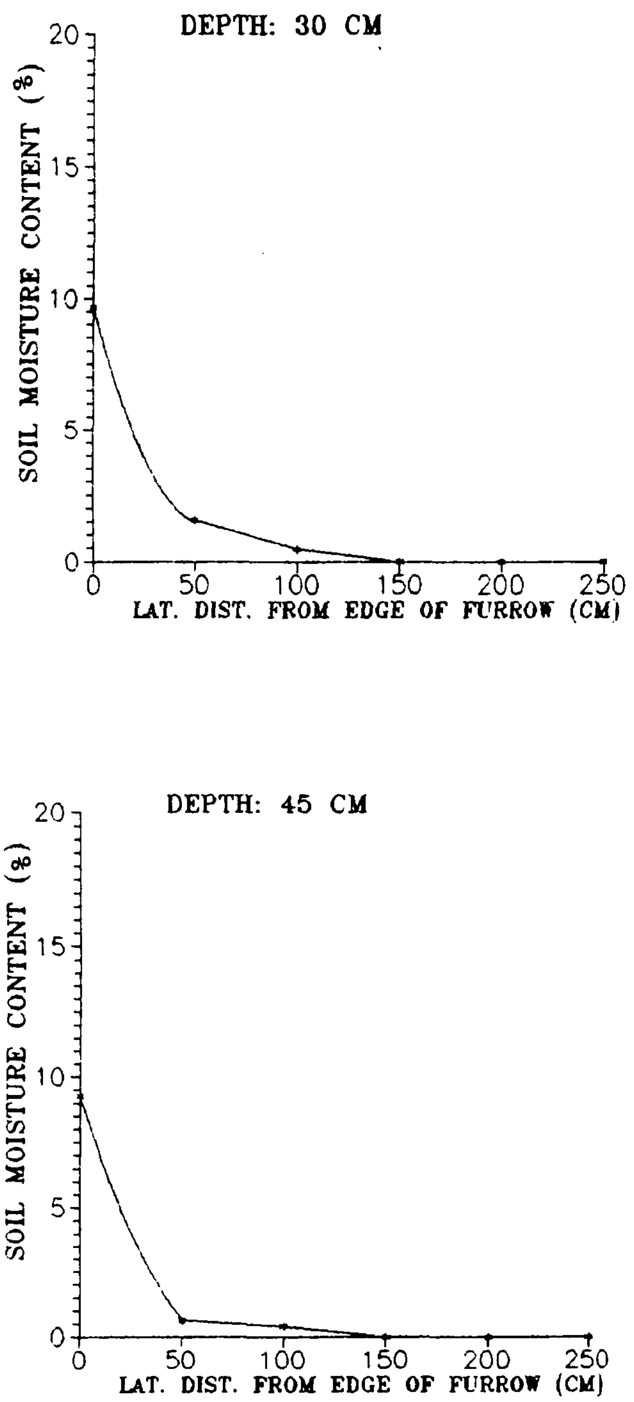


FIG. 22B: RELATIONSHIP OF THREE IMPOUNDINGS OF WATER AND SOIL MOISTURE STATUS AT 30 AND 45 CM DEPTH IN FIVE METER BED WIDTH.

lateral distance were significantly different. There was no significant difference in moisture content among the depths of 50 and 100 cm lateral distance.

It is observed that mean moisture content for the lateral distances of 0 and 50 cm at the depths of 0, 15, 30 and 45 cm were significantly different. There was no moisture gain at different depths of 200 and 250 cm lateral distances. There was a lateral soil moisture movement upto 150 cm lateral distance at a depth of 15

DISCUSSION

V DISCUSSION

The causes and consequences of the results of the experiment "Study on the effect of bedding method on moisture conservation" are discussed in this chapter, under the following headings :

1. Number of impoundings and infiltration
2. Soil moisture status and number of impoundings.

5.1 Number of impoundings and infiltration in different bed widths

The results of one impounding showed that the infiltration rate was decreased with the elapsed time. The rate of decrease was rapid initially in all the bed widths. The infiltration rate was attained almost constant after sometime, until the water completely infiltrated into the soil. The increased infiltration rate in the beginning may be due to less antecedent soil moisture content. The antecedent soil moisture content had considerable influence on the initial infiltration rate and total amount of water infiltrated, both by decreasing as the soil moisture content raises. Malik et al., (1987) also observed that increasing initial moisture, decrease in cumulative infiltration was much more in sand than in finer textured soil.

The results of the two impounding at a time indicated that the infiltration rate in the first 4 minutes was maximum for the first impounding in all the bed widths. The rate of infiltration decreased with the elapsed time in all the bed width.

The infiltration rate in the first 4 minutes was more for the second impounding, but the infiltration rate was less in the second impounding when compared to the first impounding in all the bed widths. In case of two impoundings, the time taken for complete infiltration of second impounding was more compared to first impounding. This might be attributed to the fact that increased initial moisture content reduced the infiltration rate. Nijhawan and Garg (1975) reported that the infiltration rate with successive addition of water was not dependent on soil texture, but controlled by water stable aggregates and later by dispersion co-efficient of silt or silt plus clay.

The results of the three impoundings at a time indicated that the time taken for the complete infiltration of first impounding was less compared to second impounding. The time taken for the complete infiltration of second impounding was less compared to third impounding. This may be due to the fact that increased initial moisture content reduced the infiltration rate. The infiltration rate of the third impounding was low compared to the one and two impoundings in all the bed widths. This may be due to the lining of macropores and fine sediment adsorbed on the perimeter.

Zuidema (1984) reported that the lining of macropores and a surface crust may strongly influence the infiltration process. Brown et al., (1988) also reported that the fine sediment adsorbed on the perimeter reduced intake and increased soil water tension.

5.2 Soil moisture status and number of impoundings

5.2.1 Soil moisture status and number of impoundings in 2 meter bed width

The results of the soil moisture per cent gained 24 hours after one impounding indicated that for 0 cm lateral distance at the depths of 0, 15, 30 and 45 cm had higher percentage of soil moisture, as compared to the 0, 15, 30 and 45 cm depths of 50 cm lateral distance. There was no increase in moisture content at different depths of 100 cm lateral distance. This may be attributed to the fact that the lateral soil moisture movement was very less, may be due to lot of vertical movement at the edge of the bed (0 cm lateral distance) because of more sand content when compared to clay content of the soil.

The results of the soil moisture per cent gained 24 hours after two impoundings indicated that there was a significant difference between the depths of 0 and 50 cm lateral distance. This may be attributed to the fact that the soil moisture content at 0, 15, 30 and 45 cm depths of 100 cm lateral distance. This indicated that, there was no soil moisture movement upto 100 cm lateral distance after 2 impoundings.

The results of the soil moisture per cent gained 24 hours after three impoundings indicated that there was significant difference between 0, 15, 30 and 45 cm depths of 0 cm lateral distance. This may be attributed to the fact that the soil moisture moved vertically at the edge of the furrow (0 cm lateral distance). There was no significant difference between 0, 15, 30 and 45 cm depths of 50 and 100 cm lateral distance. This indicates that the soil moisture had moved upto 50 cm lateral distance. There was no significant difference between the depths of 50 and 100 cm lateral distance. However, there was little lateral soil moisture movement after 3 impoundings.

5.2.2 Soil moisture status and number of impoundings in 3 meter bed width

The results of the soil moisture per cent gained 24 hours after one impounding indicated that for 0 cm lateral distance at a depths of 0, 15, 30 and 45 cm had higher percentage of soil moisture compared to the 0, 15, 30 and 45 cm depths of 50 cm lateral distance. This could be attributed to the fact that the soil moisture movement laterally was less compared to the vertical movement of the moisture at 0 cm lateral distance after one impounding.

The results of the soil moisture per cent gained 24 hours after two impoundings indicated that for 0 cm lateral distance at the depths of 0, 15, 30 and 45 cm had higher percentage of soil moisture when compared to the 0, 15, 30 and 45 cm depths of 50 cm lateral distance. There was no increase in soil moisture content at different depths of 150 cm lateral distance. This could be attributed to the fact that the lateral soil moisture movement was very less compared to vertical movement of moisture at 0 cm lateral distance.

The results of the soil moisture per cent gained 24 hours after 3 impoundings indicated that there was a significant difference in moisture content between the depths of 0 and 50 cm lateral distance. This could be attributed to the fact that the soil moisture moved laterally upto 50 cm. There was no significant difference between the depths of 50 and 100 cm lateral distance. However, there was a lateral movement of moisture upto 100 cm after 3 impoundings of water.

5.2.3 Soil moisture status and number of impoundings in 4 meter bed width

The results of the soil moisture per cent gained 24 hours after one impounding indicated that the soil moisture content at 0, 15, 30 and 45 cm depths of 0 cm lateral distance was significantly different. However there was no increase in moisture content at different depths of 100, 150 and 200 cm lateral distance. This indicated that there was no lateral movement of soil moisture upto 50 cm lateral distance at 30 and 45 cm depths after one impounding. The vertical movement of moisture at 0 cm lateral distance was more.

The results of the soil moisture per cent gained 24 hours after two impoundings indicated that there was a significant difference between the depths of 0 cm lateral distance. But there was no increase in moisture content at different depths of 150 and 200 cm lateral distance. This could be attributed to the fact that there was no lateral movement of moisture beyond 100 cm lateral distance.

The results of the soil moisture per cent gained 24 hours after three impoundings indicated that there was a significant difference in moisture content between 0 and 50 cm lateral distance at the depths of 0, 15, 30 and 45 cm. This could be attributed to the fact that the soil moisture moved laterally. There was a significant difference between 50 and 100 cm lateral distance at the depths of 15 and 30 cm. However, there was a lateral soil moisture movement upto 150 cm, though no lateral soil moisture movement beyond 150 cm lateral distance was observed.

5.2.4 Soil moisture status and number of impoundings in 5 meter bed width

The results of the soil moisture per cent gained 24 hours after one impounding indicated that there was a significant difference in moisture content at different depths of 0 cm lateral distance. This could be attributed to the fact that the soil moisture moved vertically at 0 cm lateral distance. There was no increase in moisture content at different depths of 0, 100, 150, 200 and 250 cm lateral distance.

The results of the soil moisture per cent gained 24 hours after 2 impoundings indicated that there was a significant difference in moisture content at different depths of 0 cm lateral distance. There was no increase in moisture content at different depths of 150, 200 and 250 cm lateral distance. This could be attributed to the fact that there was no much lateral movement of moisture after 2 impoundings.

The results of the soil moisture per cent gained 24 hours after 3 impoundings indicated that there was a significant difference in moisture content between the depths of 0 and 50 cm lateral distance. This could be attributed to the fact that the soil moisture moved laterally. There was no increase in moisture content at 30 and 45 cm depths of 150 cm lateral distance.

5.2.5 Practical application of the results

The present investigation revealed that the smaller bed widths (2 to 3 meter bed width) helps to assure the better distribution of the moisture. The plants which were closer to the furrows will have maximum benefit of moisture.

SUMMARY

VI. SUMMARY

A field experiment was conducted on red sandy loam soil of Main Research Station, Hebbal, Bangalore, to investigate the efficiency of bedding method on moisture conservation.

The experiment comprised of twelve treatment combinations with four levels of bed widths and 3 levels of water impoundings. Each treatment was irrigated separately. The volume of water applied to furrow was measured by using 90^{o}V notch. The water delivered to the furrow was stopped once the furrow was completely full. Point gauge was used to measure the infiltration rate in the furrow, until the water completely infiltrated into the soil.

The soil samples were drawn from both the sides of the bed at the lateral distances of 0, 50 and 100 cm (from the edge of the furrows) in case of 2 meter bed width (T_1); 0, 50, 100 and 150 cm (from the edge of the furrow) in case of 3 meter bed width (T_2); 0, 50, 100, 150 and 200 cm (from the edge of the furrow) in case of 4 meter bed width (T_3) and 0, 50, 100, 150, 200 and 250 cm (from the edge of the furrow) in case of 5 meter bed width (T_4). In all the bed widths, at each lateral distance soil samples were collected from 0, 15, 30 and 45 cm vertical depths. Soil samples were collected before and after 24 hours of each impoundings.

The results of the infiltration for one impounding indicated that the rate of decrease in infiltration was rapid initially in all the bed widths. The results of two impoundings indicated that the infiltration rate of the second impounding was low compared to the first impounding. The results of the three impoundings indicated that the infiltration rate of the third impounding was low compared to the first and second impounding.

The results of the soil moisture per cent gained 24 hours after one impounding indicated that there was no much lateral soil moisture movement in 2, 3, 4 and 5 meter bed widths, though the soil moisture had moved vertically at 0 cm lateral distance.

The results of the soil moisture per cent gained 24 hours after two impoundings indicated that the soil moisture had moved laterally upto 50 cm in all the bed widths, even though there was no much lateral moisture movement beyond 50 cm lateral distance.

The results of the soil moisture per cent gained 24 hours after three impoundings indicated that the soil moisture had moved laterally upto 150 cm in all the bed widths, but there was no much increase in moisture content at different depths of 150 cm lateral distance.

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VII. REFERENCES

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APPENDICES

VIII. APPENDICES

APPENDIX - 1A

Average climatological data from 1979-89 for the Main Research Station, U.A.S. Hebbal, Bangalore.

Month	Rainfall (mm)	Temperature (^{o}C)		Mean Relative humidity (%)
		Maximum	Minimum	
January	4.60	27.23	14.52	66.00
February	12.37	29.93	15.65	60.00
March	12.26	32.40	18.32	55.50
April	27.20	34.11	21.28	55.86
May	88.05	33.91	21.75	60.40
June	73.82	30.61	20.26	72.00
July	102.52	29.66	19.87	74.27
August	92.06	28.32	19.60	75.90
September	240.67	28.60	19.55	75.86
October	98.63	28.27	18.77	71.27
November	40.09	26.98	16.78	71.86
December	10.94	26.46	15.57	69.45

APPENDIX - 1B

Meteorological data of Main Research Station, Hebbal for the year 1990.

Month	Rainfall (mm)	Temperature (^{o}C)		Mean Relative humidity (%)
		Maximum	Minimum	
January	8.20	27.60	12.40	64.00
February	0.00	30.70	15.00	64.00
March	2.60	32.70	20.10	59.00
April	8.80	34.90	22.30	58.00
May	67.60	31.70	21.30	72.00
June	29.70	30.20	20.10	75.00
July	17.70	29.10	19.50	77.00
August	69.40	27.70	19.70	81.50
September	72.70	31.30	19.90	73.00
October	53.70	28.30	19.50	77.00
November	16.40	27.10	17.40	75.40
December	5.00	26.70	15.58	73.10

APPENDIX II

The discharge of water in a 'V' notch of 90^{o}

H : Height of water flowing over the 'V' notch

Height (cm)	Discharge in litre/sec.	Height (cm)	Discharge in litre/sec.
4.00	0.45	14.50	11.30
4.50	0.60	15.00	12.30
5.00	0.80	15.50	13.30
5.55	1.00	16.00	14.50
6.00	1.20	16.50	15.60
6.50	1.50	17.00	16.70
7.00	1.80	17.50	18.30
7.50	2.20	18.00	19.40
8.00	2.50	18.50	21.70
8.50	2.80	19.00	22.30
9.00	3.40	19.40	23.50
9.50	3.90	20.00	25.50
10.50	4.50	20.50	27.00
10.50	5.10	21.00	28.30
11.00	5.70	21.50	30.30
11.50	6.30	22.00	31.00
12.00	7.10	22.50	34.00
12.50	7.80	23.00	35.70
13.00	8.60	23.50	38.20
13.50	9.50	24.00	40.00
14.00	10.50		