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On farm activities for enhancing productivity through rain water in ravines affected area of Bundelkhand, Uttar Pradesh

R. A. Singh, P. K. Rathi, Dhananjai Singh, Ekhlaq Haider and S. K. Singh
Farmers Participatory Action Research Programme on Water/Water Harvesting
C.S. Azad University of Agriculture & Technology, Kanpur-208002, India
Corresponding author e-mail: rasingh_csau@yahoo.co.in
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Abstract

On farm activities to manage the rain water were followed for water resources development on watershed basis in Bundelkhand. The main objective of the study was to enhance the crop productivity on ravinous land with different on farm activities based on rain water management. Twenty five check dams were constructed earlier in the entire project area on down stream of *nalas*. The catchment area of these *nalas* bunds is about 200 ha and 20 hectometer surface water is arrested in these check dams every year, which was exploited for irrigation on 190 ha land. The mini earthen store reservoir in the form of contour bunds, submergence bunds, water harvesting bundhies, land levelling & smoothening and vegetative barrier, which were earlier formed also help in harvesting the maximum rain water under dry environment. The arrested rain water and run off control have helped in improvement of ground water table, which has risen to the extent of 3.85 m over the base year. The cropping systems followed in catchments area of check dams gave system productivity as 47.94 q/ha in sesamum-pea, 42.00 q/ha in sesamum-gram, 37.52 q/ha in sesamumï mustard and 72.48 q/ha in black gram-wheat, which was higher over the farmers practices. The cultivation on contour alignment gave system productivity of sesamum ï pea by 37.41 q/ha, sesamum ï gram by 34.86 q/ha, sesamum ï mustard by 32.89 q/ha and black gram- wheat by 54.28 q/ha. The long duration pigeon pea raised in submergence bunding gave yield of 22.00 q/ha, which was higher over farmers practices (19.50 q/ha). The cabbage and tomato yielded 255.00 q/ha and 242.00 q/ha, respectively, irrigated with recycled water in well from the water harvesting demonstration, conducted under 'Farmers Participatory Action Research programme on Water/Rain Water Harvesting'. The grain yield of pigeon pea harvested was 21.00 q/ha from the leveled field, which was higher by a margin of 1.50 q/ha or 7.70 % over farmers practices. The black gram and wheat yielded 8.50 q/ha and 47.85 q/ha, respectively, from the cropping system of black gram ï wheat followed under this soil and water conservation measures.

Key words : Arrested water, Bundelkhand, On farm activities, Participatory research, Ravines, Shallow tube well,

Introduction

On farm activities for efficient rain water use approach to reduce runoff by adopting various inter-terrace management practices including land smoothening to avoid local depression, adoption of contour bunds or vegetative bunds on the contour, summer tillage on the contour, contour sowing, frequent inter cultivation and opening ridges/furrows across the slope, compartment bunding, scooping, tied ridging, evaporation control through various types of mulches have given beneficial results. Apart from these management practices, increasing the infiltration and retention capacity of soil by improving their physical conditions by the application of various types of organic materials is important in the integrated approach for efficient use of available water in dry lands.

The principle behind the recommendation of different practices is to increase the infiltration by reducing the rate of run off, temporarily impounding the water on the surface of soil to increase the opportunity time for infiltration and modifying the land configuration for inter plot rain water harvesting. Other practices include improving the soil physical conditions so as to increase the rate of infiltration and retention in the soil system. Adoption of practices suitable for local situations helps to improve the soil moisture availability and thereby achieve higher crop yields. Manivannan *et al.* (2007) reported that soil and water conservation structures constructed for rain water

management on watershed basis increased the ground water table and crop productivity. Samuel (2010) also reported that traditional check dam construction was found to be an attractive preposition for rain water harvesting and recycling of stored water. Keeping this in view, present study has been taken up to document prevailing on farm soil and water conservation practices so that the situation specific and need - based appropriate technologies could be evolved for larger benefit of the farmers of Bundelkhand.

Materials and Methods

About 750 ha of the ravines affect area was selected in *Jalaun* district of Bundelkhand, Uttar Pradesh, India under Model Watershed Development Programme, which lies in the catchments of river *Pahuj*. The ravinous land is situated in *Hasupura*, *Rendher*, *Kanharpura*, *Kunwarpura* and *Chhiriya Khurd* villages of *Nadigaon* block of *Konch* Tehsil. The area was treated with measures like contour bunds, submergence bunds, gully plugs, check dams, vegetative bunds and land levelling and smoothening by C.S. Azad University of Agriculture & Technology, Kanpur under "Model Watershed Development Programme" from 1983-84 to 1985-86. The subjected area was again selected under "Farmers Participatory Action Research Programme on Water/Rain Water Harvesting" (Scheme of Ministry of Water Resources, Government of India) for carrying out the farmers participatory research programme on important technologies of water harvesting during 2008 and 2009. The rainfall received during the experimental year was 741 mm in 2008 and 752 mm in 2009. In this ravinous area, the rain water was managed through different on farm activities for efficient use of run off water in dry eco-system *viz.*, gully plugging and check dams, contour bunding, submergence bunding, water harvesting bundhies, land levelling and smoothening, vegetative barrier, dead furrows, deep ploughing and mulching. The sesamum-pea, sesamum-gram, sesamum-mustard, black gram-wheat cropping systems in gully plugging and contour bunding; long duration pigeon pea in submergence bunding and land levelling & smoothening; cabbage and tomato crops in water harvesting bundhies; black gram-wheat cropping system in vegetative barrier; sesamum-gram and sasamum-wheat cropping systems in dead furrows in association of contour cultivation; Jowar hybrid-wheat cropping system in deep ploughing and ginger crop in mulching were tested in the operational area. The *Kharif* crops were sown after onset of rainfall in mid July and harvested after complete maturity during both the experimental seasons. The *Rabi* season crops were seeded/ planted after pre sowing irrigation, given with impounded water in second fortnight of November and grain crops were harvested after complete maturity and vegetables at full growth stage.

The recommended doses of fertilizers were applied for all crops. Life saving irrigations was given at moisture stress condition as and when required. The other agronomical practices were followed in all the crops. Crops yield were recorded after harvesting and threshing.

Results and Discussion

Surface water management in the pilot area of watershed

The project area was badly eroded and ravinous due to five tributary of *Pahuj/ Yamuna* river passing through the operational area. Various rain water conservation measures followed in this ravinous area for better utilization of surface water.

The cropping system followed in catchment area of check dams gave system productivity as 47.94 q/ha in sesamum-pea, 42.00 q/ha in sesamum-gram, 37.52 q/ha in sesamum- mustard and 72.48 q/ha in black gram-wheat, which was higher over the farmers practices. The highest system profitability of Rs. 62763/ha was recorded in sesamum-gram cropping system followed in catchments area of gully plugging and check dams. The contour cultivation gave system productivity of sesamum-pea by 37.41 q/ha, sesamum-gram by 34.86 q/ha, sesamum-mustard by 32.89 q/ha and black gram-wheat by 54.28 q/ha. The maximum system profitability was found in sesamum-mustard cropping system, raised under contour bunding.

The long duration pigeon pea raised under submergence bunding gave yield of 22.00 q/ha, which was higher over farmer's technique (19.50 q/ha). Long duration pigeon pea gave net return of Rs. 75822/ha, under submergence bunding. The height of water in wells improved by 3.85 meter which showed that the water yield capacity of wells has improved. Increased water yield was exploited for vegetable irrigation with indigenous system *i.e.* Dhehkuli. The cabbage and tomato yielded 255q/ha and 242q/ha, respectively, irrigated with recycled water in well from the water harvesting demonstration conducted in operational area.

The grain yield of pigeon pea harvested was 21q/ha from the levelled field, which was higher from local practices. Net return of Rs. 71822 /ha was obtained from long duration pigeon pea when raised in levelled field. The black gram and wheat harvested by 8.50 q/ha and 47.85 q/ha, respectively, from the cropping system of black gram

Table 1 : Effect of different soil and water conservation on farm activities on yield, system productivity and system profitability

S.No.	On farm activity	Yield (q/ha)			System productivity (q/ha)	System profitability (Rs/ha)
		Cropping System	Kharif crop	Rabi crop		
1	Gully ploughing	Sesamum-pea	4.80	21.00	47.94	55104.00
		Sesamum-gram	4.90	28.00	42.00	62763.00
		Sesamum-mustard	4.80	25.00	37.52	59634.00
		Black gram-wheat	7.30	45.60	72.48	41510.00
2	Contour bunding	Sesamum-pea	3.80	24.00	37.41	37204.00
		Sesamum-gram	3.70	24.15	34.86	47784.00
		Sesamum-mustard	3.60	23.50	32.89	48984.00
		Black gram-wheat	5.10	36.43	54.28	24645.00
3	Submergence bunding	Long duration pigeon pea	22.00	-	22.00	75822.00
4	Water harvesting bundhies	Cabbage	-	255.00	-	-
		Tomato	-	242.00	-	-
5	Land levelling and smoothening	Long duration pigeon pea	21.00	21.00	21.00	71822.00
6	Vegetative barrier with *Saccharum munja*	Black gram-wheat	8.50	47.85	77.50	47966.00
7	Dead furrows in association of contour cultivation	Sesamum-gram	9.00	26.00	38.28	54969.00
		Sesamum-wheat	5.90	40.31	60.96	31325.00
8	Deep ploughings					
	(a) Bukhar followed by three ploughings with deshi plough	Jowar hybrid-wheat	25.85	39.20	60.89	35301.00
	(b) One ploughing with tractor driven cultivator followed by three cross ploughings	Jowar hybrid-wheat	25.10	38.70	59.87	34276.00
9	Mulching					
	(a) Mulching with live material of *Palash*	Ginger	207.00	-	-	-
	(b) Non-mulched	Ginger	193.75	-	-	-

Market price of enterprises : Sesamun - Rs. 6000/q, Black gram - Rs. 3500/q, Pigeon pea - Rs. 4000/q, Jowar - Rs. 700/q, Wheat - Rs. 1000/q, Pea - Rs. 1700/q, Gram - Rs. 2100/q, Mustard - Rs. 2300/q

ï wheat followed under vegetative barrier. System profitability of Rs. 47966/ha was recorded under black gram-wheat cropping system, when raised under vegetative barrier.

In the pilot area of FPARP Water/ Rain Water Harvesting, dead furrows in association of contour cultivation gave system productivity to 38.28q/ha of sesamum-gram and 60.96 q/ha of black gramï wheat which was superior in comparison to local practices. The cropping system sesamum - gram gave higher net return of Rs. 54969 /ha when grown with dead furrows in association of contour cultivation.

One ploughing with Bundelkhund *Bukhar* followed by three ploughing with desi plough gave 60.89 q/ha system productivity under jowar hybrid ï wheat cropping system closely followed by one ploughing with tractor driven cultivator followed by three cross ploughing (59.87 q/ha) in the of pilot area of FPARP on Water / Rain water Harvesting. Jowar hybrid - wheat cropping system gave net income of Rs. 35301/ha, when field was prepared with *Bukhar* followed by three ploughings with *desi* plough.

In the pilot area of FPARP on Water /Rain Water Harvesting, ginger yield was increased by live mulching of green leaves of local vegetation (207.00 q/ha) over non mulching (193.75 q/ha).

Ground water management in watershed site

Before the management of rain water, the ground water table in the area was about 10 m deep and there was no possibility of survival of shallow tube well due to inadequate recharge and undulating topography. Land treatments employed for rain water conservation and runoff control under ôModel Watershed Development Programmeôhave helped in improvement in ground water table which has risen to the extent of 3.85 m over the base year. The ground water was exploited for irrigation with shallow tube well operated with diesel pump sets and wells. Since the water availability in the watershed has increased tremendously due to alimenting and recharging of rain water, the irrigated area increased from 8.00 ha to 510 ha with alimented ground water. The total

irrigated area increased up to 690 ha or 99.25% with surface and ground water. The same status of moisture conservation, water harvesting and water recycling were also maintained under FPARP programme. These findings are in agreement with those of Jat *et al.* (2010), Prasad *et al.* (2010), Samuel (2010), Manivannan *et al.* (2007), Singh (1995).

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