SUMMARY AND CONCLUSION
CHAPTER VI
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The experiment entitled "Studies on growth, development and productivity of rice, soybean and black gram in relation to water management in poorly drained soil was carried out at Agriculture College Research farm, Indira Gandhi Krishi Vishwa Vidyalaya, Raipur (M.P.) during kharif season of 1985 and 1986. The main objective of the experiment was to study the growth, development and productivity of rice, soybean and black gram under varied water management treatments of in situ water harvesting. The differential soil water status and its impact on rice, soybean and black gram was also studied. Following 3 water management treatments were considered for this purpose.

T1 - In-Situ Water Harvesting system (IWHS) 1:1
T2 In-Situ Water Harvesting system (IWHS) 2:1
T3 Control (Traditional cultivation)

To examine the effect of the water management treatments, different crops were taken as per the situations.

1. Rice - grown in sunken bed in IWHS and control treatment
2. Soybean - grown in raised bed in IWHS and control treatment
3. Black gram - grown in raised bed in IWHS and control treatment

The details of these water management treatments are as below.

To prepare the In-situ water harvesting system of water management, large field area of 2 ha was selected in deep vertisol
block. About 15 cm soil depth was removed from half and one third of the total plot area and distributed on the remaining parts of the plot converting into In-situ water harvesting system 1:1 and 2:1. For further convenience this lay-out was divided into 8x70 m strips of raised and sunken bed. The raised bed works as a source and the sunken bed as a sink for collection of run-off water from the source (raised bed). This system provides drainage to soybean and black gram on raised bed and run-off water to rice in sunken bed. The effects of poor or excess rains are mitigated within the same field. It is therefore called as "In-situ water harvesting system" (IWHS). The main difference between IWHS 1:1 and IWHS 2:1 system is that the area in sunken bed would be 50% with 1:1 system and 1/3rd area in 2:1 system. Thus, the catchment area for sunken bed will be 50% in IWHS 1:1 and 66% in IWHS 2:1 systems. For statistical analysis, each crop in different treatments was divided into 10 plots of 6.4 x 5.4 m plot size.

These two systems of land and water management were compared against traditional farmer’s practice (control). For soybean and black gram crop, this was poorly drained vertisol and for rice crop, it was bunded field under rainfed conditions. The size of control plots was kept same for comparison.

The experimental results are summarized as below:

Soil moisture Status

Out of three systems, shallow water table was the most under unbundled soil (control) and it was least under the In-Situ water harvesting system in general and IWHS 2:1 in particular.
About 25 per cent seasonal rainfall can be harvested through IWHS 1:1 and 35 per cent through IWHS 2:1. The weekly rainfall and run-off relationship worked out to be

\[ Y_1 = 0.299 + 0.261 X \]
\[ Y_2 = 0.36X - 0.980 \]

Where,

\[ Y_1 \text{ and } Y_2 = \text{ Weekly run-off in IWHS 1:1 and IWHS 2:1 respectively} \]
\[ X = \text{ Weekly rainfall} \]

Field water balance studies revealed that 1985 was water stress free year for rice and excessive rainfall year for soybean and black gram. The year 1986 was good for black gram but rice suffered due to drought in reproductive stage.

Thus under raised and sunken bed system of water management, substantial amount of water can be safely drained-off from dryland crop and simultaneously it can be used for growing rice to mitigate the adversity of droughts.

**Biological Studies**

**Rice**

The plant height increased up to panicle initiations. Rate of increase was rapid during vegetables phase in rice. The dry matter accumulation was maximum at flowering. Number of leaves per sq.m increased up to active vegetative phase. The LAI was increased up to boot stage.

In the year 1985, different growth and development characters like plant height, biomass accumulation, leaf area
number of leaves and LAI were statistically similar in all the three treatments. The treatment IWHS 2:1 was statistically similar to control in most of the yield attributing characters in 1985. Thus these treatments were at par.

Effect of drought in 1986 was clearly observed in all the growth parameters and yield attributing characters. In general performance of crop was comparatively better under IWHS 2:1 followed by IWHS 1:1 and control. The grain yield of rice was drastically reduced by 43.5 per cent in IWHS 1:1 and 33.2 per cent in IWHS 2:1 in 1986 as compared to 1985 status in corresponding treatments. Whereas under control treatment, the yield was reduced by 60.6 per cent in 1986 as compared to year 1985.

Soybean

The plant height showed linear increasing trend upto pod filling (75 to 90 DAS) whereas size and number of leaves and thereby LAI reached at its maximum at 84-89 DAS.

Both the water management treatments performed statistically similar in respect to growth parameters like plant height, dry biomass accumulation, leaf area, number of leaves and LAI recorded at different intervals. Similarly the yield attributes such as number of pods per plant, number of grains per pod, pod length, pod weight per plant, grain weight, straw yield and harvest index were found to be not significant due to both water management treatments. Both the water management treatments
showed their superiority over control in respect to different growth and yield attributing characters.

**Black gram**

The plant height, dry matter accumulation per sq.m and number of leaves per plant were increased gradually from seedling to maturity. While leaf area and LAI showed increasing trend till pod formation to pod filling.

Both the water management treatments did not differ significantly in respect to plant height, dry matter accumulation, leaf area, number of leaves and LAI in 1985. Performance of above characters was too poor in control.

In the year 1986, both the water management treatments differed significantly to each other in respect to above growth characters up to early grain filling. Thereafter both were at par and showed their superiority over control.

In the year 1985, most of the yield attributes and grain yield were at par in both the water management treatments and performed significantly better over control. In 1986, number of grains per plant, number of grains per pod, pod weight per plant and grain weight per plant were significantly higher in IWHS 2:1 over IWHS 1:1. In general performance of black gram was better in 1986 when compared to 1985.
Biometric study

Grain yield of dwarf rice variety IR-36 was positively associated with harvest index, number of panicles /sq.m, panicle weight per sq.m, panicle length and sound grains per panicle. Path analysis revealed that harvest index had true relationship with grain yield.

In soybean, number of grains per pod, pod length and harvest index were significantly associated with grain yield. The harvest index had direct effect on grain yield thus it helped in varietal selection.

The grain yield of black gram was strongly associated with number of grains per pod, harvest index, pod length and pod weight per plant. The grain yield of black gram was negatively correlated with biological yield and straw yield. The path analysis showed that harvest index played an important role for better plant selection in black gram.

Economic analysis

In the present situation, cultivation under rainfed farming was risky either for growing rice or soybean. Black gram was found to be uneconomical. For stabilized production, soybean in raised bed and rice in sunken bed with 2:1 IWHS could be better substitute for alteration of cropping pattern and minimizing risk factor.