Drip Irrigation for Cash Crop Production: Results of a Trial in the Jhikhu Khola Watershed, Nepal

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Introduction

The warm sub-tropical climate in the lower parts of the Jhikhu Khola Watershed (JKW) is suitable for vegetable production – the average monthly temperature ranges from 5 to 33 ^{0}C, and rainfall averages about 1200 mm each year (Merz Dhakal and Dangol 2000). The typical rainfall pattern, in which about 80% of the annual rainfall occurs from June to September, leaves the rest of the year virtually dry. Further winter rainfall is sparse and very unreliable. During the dry period some farmers extract water from the Jhikhu Khola and its tributaries to irrigate potato and tomato fields. The parcels on rainfed agricultural lands do not have access to irrigation water and therefore remain fallow. Other farmers who have access to springs cultivate cash crops, mainly tomatoes, on small upland plots through bucket irrigation.

The People and Resource Dynamics in Hindu Kush-Himalayas Project (PARDYP) of ICIMOD, in collaboration with the Horticulture Centre Panchkhal of HMGN, Department of Agriculture, set up a trial in February 2000 to demonstrate an alternative irrigation system (drip irrigation) at the Horticulture Farm at Tamaghat in the spring season. The aim was to study the comparative advantages of drip irrigation techniques over conventional irrigation systems

Materials and Method

Two plots of similar size (12 X 12 m) were established side-by-side, one each for the drip system and the bucket system. An improved variety of bitter gourd (white long), which has a good market price, was selected for the trial.

A locally fabricated drip irrigation unit able to perform with a low water head was selected, and a medium-sized system installed in one of the plots. For installation details refer to Nakarmi, Prajapati-Merz; and Jha (in press). For the bucket irrigation method applied in the second plot, a 20 litre plastic bucket was used to haul water to the plot. Water was poured onto individual plants with the help of a 0.5l plastic jar, so that each received about 0.5l water at a time.

Results and Discussion

Bucket versus drip irrigation methods

The efficiency of the bucket method was extremely low. When equal amounts of water were provided, the bucket plot routinely appeared drier than the plot under drip irrigation. Therefore more water was applied to the bucket-method plot, often two to three times more than that applied to the drip irrigation plot. The higher water input was necessary to

compensate for water losses mainly from evaporation and surface run off. The monsoon rainfall provided adequate water from the 14th week, and no irrigation water was required from then onwards.

Labour for Crop Management

The bucket irrigation plot required 200% more labour than the drip plot. Though an equal effort was needed for land preparation and to put up the supporting sticks, about 33% more effort was needed to weed the bucket plot, and 600% more effort to irrigate it. It took about 20 minutes to apply 40l of water to the drip plot (10 minutes to fill the tank, 10 minutes to empty the tank), while it took about 50 minutes to apply the same amount of water to the bucket plot. The overall crop management cost was three times more with the bucket method.

Water Application versus Yield

The total amount of water used in the plot irrigated under the bucket method was 6330 litres, nearly three times higher than that in the drip plot, 2240 litres. The cumulative production from plots under drip and bucket methods were 612.1 kg and 638.8 kg, respectively. This is a difference of 4%, but the real difference in production was only 2%, because 2 out of 96 plants in the drip plot were actually sterile (male) plants, which did not fruit. The plot under bucket irrigation consumed three times more water but the total yields from each plot were not significantly different. This implies that bucket irrigation is less efficient and wastes precious water.

Because of the onset of pre-monsoon rain from the start of the flowering of the plants, however, this study did not elucidate the complete effects of the two irrigation systems.

Cost-Benefit Analysis

An analysis of benefit was conducted on the basis of the expenditure for seedlings, chemical fertiliser, actual cost to purchase the irrigation system, and the labour cost for crop management (field preparation, irrigation, weeding, and putting up supporting sticks). The labour cost was calculated at the rate of Rs 100[1] per day. The source of income was the fruit production from the plots. During the study, the price of bitter gourd fluctuated between Rs 12 and 18 per kg, thus it was calculated at the rate of Rs. 15 per kg. Total expenditure for the drip plot was Rs 2712, against an income of Rs 9182, yielding a net profit of Rs 6470. The expenditure for the bucket plot was Rs 2972, against an income of Rs 9582, yielding a net profit of Rs 6610.

Setting up the drip plot involved an initial capital cost of Rs 1450. Because this system has a useful life of at least five years (according to the IDE), an actual cost-benefit analysis is possible only on the basis of five-year data. Nevertheless, it seems a net profit of about NRs 6000 can be made from a plot of 144 m^2 by growing bitter gourd.

[1] In 2001, NRs 73 = US $ 1 approx.

Conclusion

In cultivation of bitter gourd, the drip irrigation system has several benefits over bucket irrigation because the water application in the former method is substantially lower owing to minimum losses to evaporation, surface runoff, and deep infiltration. Moreover, time to irrigate the plots is reduced, thus reducing the labour cost for crop management. The trial indicated that under conditions of limited access to water, small-scale farmers with small budgets can improve their incomes using drip irrigation systems to grow bitter gourd.

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