



Vegetables Production in Drip Irrigation and Conservation Agriculture for the Disadvantaged Women in Siem Reap, Cambodia

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Figure 1. Cabbages in Conservation agriculture with *Crotolaria juncea* cover crop



Figure 2. Farmer watering plants using water two- ten liter sprinklers



Figure 3. Farmer filling up 500 L drip irrigation tank. It costs about \$0.22 per one full tank using the pump

Introduction

Production during the dry season is challenging to most vegetable farmers due to lack of water. The practice of conservation agriculture involving, minimum soil disturbance-no tillage, continuous mulch, and diverse species; enhances soil moisture retention as well as reduces labor due to no tilling. Complemented by drip irrigation labor needs are further reduced.

Methods

Farmers were introduced to drip irrigation and conservation agriculture in June 2013. We trained 15 farmers. The farmers belong to 3 women self help groups. Shown are results of one farmer group at Sothnikum village, Siem Reap, Cambodia. The experiment was laid out in randomized complete block design with 5 replications with each farmer as a replication. Yield and prices were monitored and labor data were gathered from observation and also by farmers and field workers best estimates. Chinese kale was planted during the rainy months as first crop and followed by cabbage during the partly dry season. Treatment are as follows: T – Tilled, TD – Tilled with Drip, CA- Conservation Agriculture and CAD- Conservation Agriculture with Drip.

Results and Discussion

Yield of Chinese kale and Chinese cabbage did not differ significantly among treatments in both cropping seasons (Table 1). On the average kale and cabbage production was 12.8 tons ha⁻¹ and 38.3 tons ha⁻¹, respectively. Kale was during the initialization stage so all treatments were in tilled system.

Differences in expenses (Table 2) can be observed on the second crop where farmers no longer till the soil but have to transfer mulch of about 150 kg per 100 m² for a 6 cm thickness. This mulch is in lieu of cover crop residues. Farmers have about 100 m² of vegetable space. Using this space to grow cover crops cuts farmers income by one production season. Cover crops such as *Crotolaria* were planted about 20 days before cabbages were harvested (Figure 1). Its planting between spaces of cabbages gave a low plant density hence for the following crop the use of rice straw mulch was still needed. Rice straws are readily available in these farms and using them for mulch does not compete with the animal needs. Mulch in CAD protected the drip tapes from the sun's heat. Under intense sun exposed drip lines have an average temperature of 40°C while 32°C for the covered ones. Drip lines in T are expected to break faster than in CAD. Watering using sprinklers took about 35-40 minutes per 100 m² of vegetable plot per day (Figure 2). Farmers gained free time by doing drip irrigation. Labor time during the establishment phase (kale production) did not differ since CA and CAD were tilled for uniformity (Table 3). Since it was the rainy season, drip irrigation was rarely used during kale production. The bulk of the labor difference comes from irrigation

Table 1. Vegetable yield for two growing seasons.

Vegetable Yield	T Tilled	CA Conservation Agriculture	TD Tilled with drip irrigation	CAD Conservation Ag. With Drip
-----Yield (Kg) per100 m ² -----				
Chinese Kale (1 st crop)	115	134	121	141
Chinese Cabbage (2 nd crop)	391	397	362	382

Table 2. Income in two vegetable growing seasons.

Income of Vegetables	T Tilled	CA Conservation Agriculture	TD Tilled with drip irrigation	CAD Conservation Ag. With Drip
----- Chinese kale (first crop) per 100 m ² -----				
Gross income USD (G)	115	134	121	141
Expenses USD (E)	24	27	39	34
Net Income USD (G-E)	91	107	82	107
----- Chinese cabbage (second crop) per 100 m ² -----				
Gross income USD (G)	165	164	152	164
Expenses USD(E)	41	39	59	49
Net Income USD (G-E)	123	125	92	115

Table 3. Labor time for two vegetable growing seasons.

Labor time	T Tilled	CA Conservation Agriculture	TD Tilled with drip irrigation	CAD Conservation Ag. With Drip
----- labor hours per 100m ² -----				
Vegetables				
Chinese kale	47	43	48	46
Chinese cabbage	75	70	54	49

Summary and Conclusion

We found that differences in yield between treatments were not observed in both kale and cabbage. It was evident that conservation agriculture with drip irrigation reduces labor burden on farmers from watering and weeding; drip irrigation and conservation agriculture are complementary.

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