EFFECT OF ORGANIC MANURE AND CHEMICAL FERTILIZER APPLICATION ON FRESH CHERRY PRODUCTION OF COFFEE

K. B. Thapa, Y. R. Bhusal, R. B. KC, Durga D. Paudel
Agriculture Research Station, Malepatan, Kaski

ABSTRACT

A study was carried out for two years on fresh cherry production of coffee at Agriculture Research Station (Horticulture), Pokhara. The effect of six different treatments of organic and chemical fertilizers was studied in four varieties of coffee namely Pacamara, Selection-10, Tekisic and Yellow Caturra. The experiment was laid out in a factorial randomized complete block design with split plot and three replications. The data on fresh coffee cherry production was collected in 2008 and 2009. The combined application of double doses of farmyard manure plus single dose of chemical fertilizer (FYM @ 10 t ha^{-1} + chemical fertilizers 100:30:60 kg NPK ha^{-1}, respectively) gave the highest amount of fresh cherry yield (1271.9 kg ha^{-1}) and followed (1005.3 kg ha^{-1}) by the application of double dose of farmyard manure only. The lowest yield (532.10 kg ha^{-1}) of fresh cherry was observed due to application of double doses of chemical fertilizer only (200:60:120 kg NPK ha^{-1}, respectively). In case of variety, Yellow Caturra gave the maximum cherry yield (1219.52 kg ha^{-1}) followed by 'Selection-10' (875.95 kg ha^{-1}). This study revealed that the application of farmyard manure in combination with chemical fertilizer is suitable to produce more cherry production of coffee as compared to application of only one type of either organic or chemical fertilizer. It also indicated that application of higher dose of chemical fertilizer without addition of organic manure is not effective to get more cherry yield of coffee.

Key words: Coffee-farmyard manure-chemical fertilizer-fresh cherry

INTRODUCTION

Coffee is perennial plant and evergreen in nature. The Arabica coffee grows well up to the altitude of 1500m masl with the annual total precipitation ranging from 1600mm – 2500mm and annual average temperature ranges from 15^{0}c to 25^{0}c (CCRI, 2000). The number of coffee growing countries is 100 or more in the world and more than 50 countries are growing coffee in commercial scale. About 6.78 million tons of coffee green bean was produced during 2001/02 and the records on coffee productivity varied from 780 kg ha^{-1} to 1582 kg ha^{-1} in the world. Coffee is an important and a new cash crop in the hilly districts of Western and Central Development Region of Nepal. The area and production during 2003/04 were 764 ha and 187.5 mt, respectively. The productivity of coffee green bean in Nepal is very low (300 kg ha^{-1}) as compared to other coffee producing countries (e. g. Brazil 900 kg ha^{-1}and Guatemala 782 kg ha^{-1}). Therefore, processing plants located in the different parts of the country are running far below their capacities due to inadequate supply of the coffee beans. Unavailability of high yielding coffee varieties and lack of improved cultivation practices are the major causes of low production. Therefore, identification of better nutrient management with suitable high yielding variety of coffee is required to increase the coffee production. Keeping these points in view, ARS (Horticulture), Malepatan started research in coffee production since the fiscal year 2003/04 in Kaski district with following objectives.

- To identify and recommend economic doses of organic and inorganic fertilizers requirements for coffee
- To identify and recommend high yielding coffee varieties suitable to similar agro-ecological zones

Site characterization

Site: ARS (Hort.), Malepatan, Kaski; Latitude: 28^0 13' 6.18" North; Longitude: 83^0 58' 27.71" East; Elevation: 848masl; Slope: 5 %; Aspect: South-West; Climate: sub-tropical. The meteorological records averaged for 15 years (1991 - 2005) indicated that mean maximum temperature range is 19.2^{0}c to 30.5^{0}c. Similarly, mean minimum temperature range is 6.6^{0}c to 22.1^{0}c. May, June, July and August (30.1^{0}c to 30.5^{0}c) are the hotter months, where as December and January (6.6^{0}c to 7.8^{0}c) are the cooler months. The annual total precipitation (averaged for 15 years) is 4112.1mm at the site. About 80 % of the total rainfall appears during the four months (June to September) and the highest in July(1015.3mm).The Station also receives hailstone damages during February to May and some times in September-October (Annual report, 2006/07).

MATERIALS AND METHOD

Agriculture Research Station (Horticulture) farm was selected as an on-station coffee research site. The experimental plots were laid out in a factorial RCBD with split plots in about 1500 square meters of land. Four varieties of coffee (Pacamara, Selection-10, Tekisic and Yellow Caturra) were planted by adopting six treatments with three replications. The size of pits prepared were 0.50m x 0.50m at the distance of 2m and filled with farmyard manure, soil and fertilizer as according to treatments mentioned below. Coffee seedlings were planted during July 2004 with the help of planting board by maintaining 2m between plant to plant and row to row distance accordingly. The first harvest of the cherry was practiced during the year 2007. It was a preliminary bearing. Therefore the data was not recorded for that year. When the cherry bearing appeared for the second year (2008), then collection of data on fresh cherry yield started. In this way, data on fresh cherry yield was collected for two years (2008 and 2009). The collected data was analyzed by using statistical software 'M-STATC'. The manure and fertilizers applied to different varieties of coffee were as follows.

Treatments

T_1- Farmyard manure @ 5 t ha^{-1}
T_2- Farmyard manure @ 10 t ha^{-1}
T_3- Chemical fertilizer @ 100:30:60 NPK kg ha^{-1}
T_4- Chemical fertilizer @ 200:60:120 NPK kg ha^{-1}
T_5- Farmyard manure @ 10 t ha^{-1}and + Chemical fertilizer @ 100:30:60 NPK kg ha^{-1}
T_6- Control (untreated)

RESULTS AND DISCUSSION

Fresh cherry yield of coffee (kg ha^{-1}) due to different doses of manure and fertilizers applied

The harvesting of coffee cherry started in December and ended during March in each year (2008 and 2009). The number of harvests varied from three to four depending upon varieties. All data related to fresh cherry yield was collected and compiled as accordingly. The analyzed values on fresh cherry yield of coffee are presented in Table1.

Table 1. Effect of different doses of manure and fertilizers on fresh cherry yield (kg ha^{-1}), of coffee ; average of two years (2065 &2066)

Manure and fertilizer	Variety				
	Pacamara	Selection-10	Tekisic	Yellow Caturra	Mean$^{\beta}$
FYM @ 5 t ha^{-1}	969.33	295.83	542.00	1437.23	811.10^{bc}
FYM @ 10 t ha^{-1}	701.60	1137.83	470.23	1711.73	1005.35^{ab}
-NPK @ 100:30:60 kg ha^{-1} res.	422.98	718.85	670.30	734.42	636.64^{bc}
NPK @ 200:60:120 kg ha^{-1}res.	317.60	677.50	398.82	734.50	532.10^{c}
FYM @ 10 t ha^{-1} + NPK @ 100:30:60 kg ha^{-1} res.	503.50	1304.23	1489.00	1790.92	1271.91^{a}
Control	856.83	1121.48	533.17	908.30	854.95^{abc}
Mean$^{\theta}$	628.64^{B}	875.95^{AB}	683.92^{B}	1219.52^{A}	GM=852.01
	LSD (0.05)	F-test	CV (%)		
Year (L)			88.76		
Variety (A)	384.6	*			
Treatment (B)	434.4	*			
L x A x B		NS			

Note:

* : Significant at 5% level.

B : Means in the column (treatment or manure and fertilizer mean) with similar letters are not significantly different by LSD (0.05).

Θ : Means in the row (variety mean) with similar letters are not significantly different by LSD (0.05).

The mean value on fresh cherry yield of coffee was observed the highest (1271.90 kg ha^{-1}) due to combined application of double doses of farmyard manure plus single dose of chemical fertilizer (@ 100:30:60 NPK kg ha^{-1}, respectively) and the yield was followed (1005.35 kg ha^{-1}) by the use of double doses of farmyard manure only. The fresh cherry yield was observed the lowest (532.10 kg ha^{-1}) due to application of double doses of chemical fertilizer (@ 200:60:120 NPK kg ha^{-1}, respectively). Based on mean value obtained from preliminary two years yield data indicated that the coffee variety, Yellow Caturra gave the highest fresh cherry yield (1219.52 kg ha^{-1}) followed by Selection-10 (875.95 kg ha^{-1}). The lowest fresh cherry yield (628.64 kg ha^{-1}) was observed in coffee variety Pacamara. The difference of means was observed to be significant in both treatments and varieties. The interactions in all cases were non-significant.

Above results on cherry yield shows that when we apply the organic manure and chemical fertilizer together then there would have more chances of availability of more amounts of plant nutrients to coffee plant. Year wise study on manure and fertilizer during 2065 also the fresh cherry yield was the highest (1326 kg ha^{-1}i. e. equivalent to 245.31 kg green bean per hectare) due to the combined application of farmyard manure and chemical fertilizer (Thapa *et al*, 2067). The combined application of organic manure and chemical fertilizer was observed to be efficient for coffee plant growth (Thapa *et al*, 2009). However, the plant growth performance due to application of higher dose of inorganic fertilizer alone was inconsistent (Thapa *et al*, 2009). Chaudhary *et. al.* (2009) had found that the coffee genotype Cattura amerello of Arabica species was found suitable for coffee production at western mid hills of Nepal. However, the 'Yellow Caturra' showed the better performance in Malepatan condition. The mean fresh cherry yield of coffee from Table 1 is converted into green bean yield of coffee and shown in Table 2.

Table 2. Conversion of fresh cherry into green bean yield of coffee

SN	Mean fresh cherry yield (kg ha^{-1})	Mean green bean yield (kg ha^{-1})
1	811.10	150.05
2	1005.35	185.99
3	636.64	117.78
4	532.10	98.44
5	1271.91	235.30
6	854.85	158.17
Mean	GM=852.01	157.62

Note: 100 kg fresh cherry =18.5 kg green bean (Deoju, 2061)

The green bean yield of coffee varied from 98.44 kg ha^{-1} to 235.50 kg ha^{-1} which is very low as compared to foreign countries. The green bean yield of Columbia and Costa Rica are 780 kg $ha^{-1}$and 1582 kg ha^{-1}, respectively (Dhakal, 2061). There is only three times of cherry harvesting after plantation of coffee seedlings. Therefore, it is preliminary yield. These coffee plants will give cherry yield maturity after eight to ten years of regular bearing.

CONCLUSION

This result indicated that the combined application of farmyard manure and chemical fertilizer was most efficient to harvest more amount of fresh cherry of coffee at Malepatan condition. It also indicated that the application of higher dose of chemical fertilizer in absence of organic manure addition didn't show positive response on cherry production of coffee.

ACKNOWLEDGEMENT

The authors would like to duly acknowledge to Nepal Agricultural Research Council (NARC) for its financial support to carry out this study. The valuable help and cooperation from the staff of ARS (Hort.), Malepatan during the study is highly appreciated.

REFERENCE

ARS, Malepatan. 2007. Annual Report on coffee (F.Y. 2006/07). Pp-5.

CCRI.2000. *Coffee Guide*. Published by Dr. R. Daidu. Coffee Research Station, Chikmagalur, Karnataka, India. Pp7-25.

Chaudhary, J.N.; Yuba R. Bhushal, Chiranjibi Adhikari and R.P. Yadav.2009. Performance Evaluation of Coffee Genotypes in the Western Hills of Nepal. NAST, NARC and NHS published, the *"Proceedings of the Fifth National Seminar on Horticulture"*, June 9-10, 2008, Kathmandu, Nepal. pp177-187.

Dhakal, B. R. 2061. *Coffee Manual*, NTCDB, Kathmandu (Version-Nepali). pp.2-6.

Thapa, K.B.; Madhu, S. Ghale, Yuba, R. Bhusal, Him, P. Pathak and Janardan Ghimire.2009. Development of Improved and Sustainable Package of Production Technology for Commercialization of Coffee Cultivation. Acharya, U.K.; N. P. Adhikari, D.P. Sherchan, P.K. Yadav and K. B. Karki.(eds.), the 'Proceedings of the Second National Workshop on Commercial Crops. 14-15 November, 2005, held at NARI, Khumaltar, Lalitpur. pp62-66.

Thapa, Krishna B.; Ram B. KC, Yuba R. Bhusal and Him P. Pathak. 2009. Effect of different organic and inorganic fertilizer combinations on plant growth of coffee. NAST, NARC and NHS published, the *"Proceedings of the Fifth National Seminar on Horticulture"*, June 9-10, 2008, Kathmandu, Nepal. pp197-202.

Thapa, K. B.; Ram B. KC and Durga D. Paudel. 2067. Research Attempts on Coffee Farming. First edition, NARC, Agriculture Research Station (Horticulture), Malepatan, Pokhara (Version-Nepali). Pp7-8.

TCDS. 2061. An Overview of Specialty Coffee. Deoju, L. N. and Sangeeta Manandhar (eds.), first edition, Fruit Development Directorate, DOA, MoAC, Nepal. pp-13.