

Influence of Intercrops on Cropping, Quality and Relative Economic Yield of Sweet Cherry cv. Bigarreau Noir Grossa (Misri)

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Abstract

An experiment was conducted to assess the impact of different intercrops like maize, pea, strawberry, cabbage, red clover, french bean, oats and maize on cropping, quality and relative economic yield of cherry cv. Misri under Kashmir conditions. The results obtained revealed significant improvement in cherry trees intercropped with leguminous crops like pea, red clover and french bean than clean cultivation and heavy feeder crops (requiring high level of soil nutrients) like strawberry, cabbage, oats and maize. Highest per cent fruit set, fruit maturity, fruit yield and fruit physico-chemical characteristics were recorded maximum in cherry trees with leguminous type of crops. The impact of intercrops on relative economic yield of cherry (system equivalent yield) revealed that the cherry plants intercropped with pea had better benefit: cost ratio (1.71) followed by cabbage (1.41), red clover (1.40) and French bean (1.39) than clean cultivation (1.34).

Keywords: Intercropping, Sweet cherry, Quality parameters, Fruit yield, Relative economic yield

1. Introduction

Cherry occupies an important position among temperate fruits all over the world and is the season's first tree fruit to reach the market. The areas having good winter rains and dry cool summers are ideal for its cultivation. Southern hill slopes with adequate air drainage is preferable sites. Cherry trees and buds are somewhat hardier to cold and buds require about 1000 hrs of winter chilling. Its commercial cultivation is mostly confined to Turkey, Europe, USA and to a lesser extent to Argentina and Japan. In India, the states of Jammu and Kashmir, Himachal Pradesh and Uttarakhand are main contributors of cherry cultivation. However, Jammu and Kashmir state have major share with an area of 3874 ha and with the production of 9530 metric tons (Anonymous, 2015).

The most of the area occupied by this crop in the state is under rain fed conditions. The interspaces between the plants under such conditions not only go without productive use but also become vulnerable to weeds. So growing of intercrops within the interspaces not only provides additional crop, high economic returns but there will be also greater utilization of natural resources which enhances uptake of nutrients. Orchardists usually cultivate several crops in between tree spacing to avoid infestation of perennial weeds. These perennial weeds go deeper into soil for moisture and transpire a lot of water. Due to crop-weed competition fruit trees suffer from water stress so cause a set-back to fruit yield and quality. Intercropping is, therefore, one of the most important factors of orchard soil management system (Derr, 2001). So once it is practiced, it will be the top agricultural option for today and tomorrow as well as for achieving an upswing growth rate in agriculture on a sustainable basis ensuring food and nutritional security, environmental safety (Vandermeer, 1989), achieving social and gender equity, generating employment and alleviating poverty.

So, this system seems to be the possible solution to meet the continuous increase in demand for food, stability of income and diverse requirements of food, thereby improving the nutrition for small scale farmers with limited resources. Thus keeping in view the above points, the present investigations was carried out to determine the influence of intercrops on cropping, quality and relative economic yield of commercial and most liked cherry cv.

Bigarreau Noir Gossa (Misri) at Ambri Fruit Research Station, Pahnoo, Shopian SKUAST-Kashmir during the year 2008-2009.

2. Materials and Methods

Present investigations were carried out at Ambri Fruit Research Station, Pahnoo, Shopian, SKUAST-Kashmir (Jammu and Kashmir) on 9-year-old uniform plants of cherry cv. Bigarreau Noir Gossa (Misri) grafted on colt rootstock during the years 2008 and 2009. The plants were spaced 4x4m apart. Intercultural operation was done on 4 plants per plot with plot size of 16m². The experiment comprised of 8 treatments each replicated thrice in a randomized block design. All the cultural practices were adopted as per SKUAST-K package of practices. Cultivation of rabi crop was followed by kharif in first year and again repeated in next year with same sequence. Data on yield parameters were recorded as percent fruit set and fruit retention of each experimental plot calculated at fruitlet stage by using the formula suggested by Westwood (1993). Fruit maturity was worked out from the date of full bloom to the date when the fruit was actually harvested. Fruit yield was estimated by taking weight of all the fruits harvested from the tree under each treatment and expressed as kg/tree. Yield of intercrops (qt/ha) was calculated after harvesting the crops and sold them to the nearby market as per the rates estimated by the Local market.

Average fruit weight was determined by individually weighing the fruits obtained from each experimental plant on a top pan sensitive balance and their weight was recorded in grams. Fruit anthocyanin (mg g⁻¹ fruit) was measured by calorimetric procedure as suggested by (Rangana, 1986). TSS was measured with the help of Zeiss hand refractometer. Titrable acidity was determined by titration method and values were expressed as percentage of malic acid (Rangana, 1986). Total sugars were determined by Lane and Eynan method (A.O.A.C., 1984). The economics of cherry was worked out by determining the impact of intercrops raised on the relative economics of cherry as (system equivalent yield) and was represented in terms of Benefit: Cost ratio. The data recorded was subjected to statistical analysis in S-plus software.

3. Results and Discussion

3.1 Effect of Intercrops on per Cent Fruit Set, Fruit Maturity and Fruit Yield

The data presented in Table 1 revealed that per cent fruit set, fruit maturity and fruit yield were significantly influenced by the use of intercrops. Per cent fruit set and fruit yield were recorded highest in cherry trees intercropped with pea followed by red clover, french bean, control (clean cultivation), strawberry, cabbage, oats and maize. However, control (clean cultivation) recorded the higher per cent fruit set, and fruit yield than heavy feeder crops like strawberry, cabbage, oats and maize. This was due to the reason that cherry trees intercropped with leguminous crops received adequate nutrients like N,P and K and moisture, which are capable of producing dark green colored leaves and thus encourages fruit bud formation, more synthesis of carbohydrates and translocation of photosynthates which might have contributed in improvement of yield and yield attributing traits and in crops like maize and oats, uptake of nutrients gets restricted as these heavy feeder crops transpire more and extract huge amount of moisture from the soil, thereby affecting the nutrient availability and their uptake. These results are in line with (Guerrero-Prieto et al., 1985) and (Kanwar, 2000).

Fruit maturity in cherry trees occurred earlier with leguminous crops (pea, red clover and french bean). However, more number of days to mature fruits was recorded in cherry trees with heavy feeder crops like oats and maize. This might be due to the reason that low nutrient availability to the trees reduces the rate of metabolism, which results in low carbohydrate synthesis and consequently less flower bud formation. Secondly nutrients required for opening of buds also gets restricted thereby enhancing more number of days to mature fruits. These results are in conformity with (Westwood, 1988).

Table 1. Effect of intercrops on per cent fruit set, fruit maturity and fruit yield in cherry cv. Bigarreau Noir Grossa (Misri)

Treatment	Per cent fruit set			Fruit maturity (DAFB upto date of harvesting)			Fruit yield (kg/tree)		
	2008	2009	Pooled	2008	2009	Pooled	2008	2009	Pooled
T ₁ Maize	10.00	11.00	10.49	74.72	75.99	75.36	14.00	15.60	14.90
T ₂ Pea	12.09	13.33	12.48	69.22	70.08	69.97	16.84	17.75	17.30
T ₃ Strawberry	10.33	11.31	11.82	72.95	73.85	73.45	15.18	16.20	15.70
T ₄ Cabbage	10.10	11.09	10.60	72.69	73.70	73.20	14.75	15.35	15.09
T ₅ Red clover	11.33	12.60	11.97	69.75	70.70	70.22	16.50	17.53	17.04
T ₆ French bean	11.00	12.35	11.66	70.89	71.58	71.24	16.15	17.33	16.75
T ₇ Oats	10.07	11.01	10.51	73.57	74.78	74.18	14.10	15.66	14.89
T ₈ Clean cultivation (control)	10.50	11.83	11.18	71.72	72.96	72.36	15.55	16.40	15.98
CD (P≤0.05)	0.32	0.24	0.26	0.42	0.60	0.26	0.32	0.21	0.11

3.2 Effect of Intercrops on Fruit Weight and Fruit Anthocyanin

The data presented in Table 2 revealed that fruit weight was also appreciably influenced by the use of different intercrops. Fruit weight was recorded highest in cherry trees intercropped with pea, red clover and french bean. However, lowest fruit weight in cherry trees was recorded with heavy feeder crops like oats and maize. This may be due to the reason that leguminous crops particularly clovers have increased water infiltration capacity of soils which, in turn, enhanced the nutrients uptake especially those of K and Ca which needs prerequisite amount of soil moisture for uptake while pea results in higher availability of N, which might have helped to increase uptake of nutrients and thus increased dry matter accumulation. The control and heavy feeder crops decreased rates of water infiltration perhaps due to surface sealing, compaction and unfavorable particle size distribution. Apart from these factors fruit weight also depends on vigor of variety, crop density and fruit leaf ratio-which is in agreement with the study carried out by (Brown, 1960) and (Sirrime et al., 2008).

Fruit anthocyanin in cherry was found to be significant and highest with leguminous crops like red clover followed by french bean and pea and lowest was recorded with oats and maize. These results are in conformity with (Dever et al., 1996).

Table 2. Effect of intercrops on fruit weight and fruit anthocyanin in cherry cv. Bigarreau Noir Grossa(Misri)

Treatment	Fruit weight (cm)			Fruit anthocyanin (mg g ⁻¹ g fruit)		
	2008	2009	Pooled	2008	2009	Pooled
T ₁ Maize	3.43	3.45	3.44	4.31	4.32	4.32
T ₂ Pea	4.05	4.08	4.06	4.25	4.28	4.29
T ₃ Strawberry	3.61	3.63	3.62	4.36	4.34	4.36
T ₄ Cabbage	3.52	3.54	3.53	4.30	4.33	4.31
T ₅ Red clover	3.98	4.01	3.99	4.42	4.47	4.44
T ₆ French bean	3.85	3.88	3.86	4.38	4.39	4.37
T ₇ Oats	3.48	3.50	3.49	4.25	4.28	4.29
T ₈ Clean cultivation (control)	3.74	3.76	3.75	4.29	4.30	4.30
CD (P≤0.05)	0.30	0.34	0.31	0.01	0.02	0.01

3.3 Effect of Intercrops on Fruit TSS, Fruit Acidity and Total Sugars

The data presented in Table 3 revealed that highest fruit TSS and fruit sugars were recorded in cherry trees under legumes (pea, red clover and french bean) and minimum was recorded in trees under maize. Maximum fruit acidity was recorded in cherry trees under french bean followed by red clover, pea, strawberry, cabbage, oats and maize. However, the lowest fruit acidity was observed in cherry trees under maize. This may be due to the reason that more the uptake of nutrients, more carbohydrate synthesis, more will be formation of sugars which in turn increases the total soluble solid concentration in fruits. These results are in agreement with (Tang et al., 1984) and (Bhutani et al., 1995).

Table 3. Effect of intercrops on fruit TSS, fruit acidity and total sugars in cherry cv. Bigarreau Noir Grossa (Misri)

Treatment	Fruit TSS (%)			Fruit acidity (%)			Total sugars (%)		
	2008	2009	Pooled	2008	2009	Pooled	2008	2009	Pooled
T ₁ Maize	18.55	18.67	18.62	0.59	0.61	0.60	10.80	10.83	10.81
T ₂ Pea	19.93	20.05	19.98	0.65	0.68	0.67	11.17	11.23	11.20
T ₃ Strawberry	19.09	19.21	19.16	0.62	0.64	0.63	10.90	10.95	10.93
T ₄ Cabbage	18.88	19.00	18.95	0.61	0.63	0.62	10.87	10.92	10.90

T ₅ Red clover	19.71	19.83	19.78	0.67	0.70	0.69	11.10	11.16	11.14
T ₆ French bean	19.55	19.67	19.62	0.69	0.72	0.70	11.03	11.10	11.07
T ₇ Oats	18.63	18.75	18.70	0.60	0.62	0.61	10.82	10.86	10.85
T ₈ Clean cultivation (control)	19.28	19.40	19.35	0.63	0.65	0.64	10.96	10.99	10.98
CD (P≤0.05)	0.12	0.15	0.13	0.02	0.01	0.01	0.06	0.04	0.03

3.4 Effect of Intercrops on Relative Economic Yield

The data presented in Table 4 revealed that cherry trees intercropped with pea recorded a net income of Rs. 186829.90 per ha with a benefit cost ratio of Rs. 1.32 followed by cabbage (Rs. 177784.00 per ha) with a benefit cost ratio of Rs. 1.28 and french bean to Rs. 165746.00 per ha with a benefit cost ratio of Rs. 1.10, respectively. This was mainly due to the increased yield, better marketing prices and net income obtained from these intercrop legumes while other treatments also appeared to be economical in view of benefit cost ratio. These results are in conformity with (Bhuvaet al., 1988) and (Kishore et al., 1997).

Table 4. Effect of intercrops on relative economic yield of cherry cv. Bigarreau Noir Grossa(Misri)

Treatments	Pooled cherry yield (kg/ha)	Yield of intercrop (q/ha)	Income obtained from intercrops (Rs.)	Cherry equivalent intercrop yield (kg/ha)	Total system yield (kg/ha)	Total cost of cultivation (Rs.)	Gross return (Rs/ha)	Net return (Rs./ha)	Benefit cost Ratio
T ₁ Maize	3874.00	35	28000	466.60	4340.60	120426.00	260436.00	140010	1.16
T ₂ Pea	4498.00	23	57500	958.30	5456.30	140550.00	327379.00	186829.9	1.32
T ₃ Strawberry	4082.00			2300.00	6382.00	177582.00	255280.00	77698.00	0.44
i) Fruit		13	52000						
ii) Runner		40,000	40000						
T ₄ Cabbage	3923.40	1.35	81000	1350	5273.40	138620	316404.00	177784	1.28
T ₅ Red clover	4430.40	110.00	11000	1833	4613.70	145837	276823.90	130986.9	0.89
T ₆ French bean	4355.00	22	55000	916.60	5272.00	150550	316296.00	165746	1.10
T ₇ Oats	3871.40	210	21000	350.00	4221.40	121729	253284.00	131555	1.08
T ₈ Clean cultivation (control)	4154.80	-	-	-	-	130000	249288.00	119288	0.91

*Maintenance cost of established orchard Rs. 5,000/kanal.

4. Conclusion

From the foregoing results it can be inferred that intercropping Cherry trees with legume crops like, pea, red clover and French bean is beneficial for sustainable development of farmers as it has potential to give maximum returns. It can also contribute substantially for overall development of orchardists and crops like clovers should be used as companion crops to improve infiltration capacity, physical conditions and water holding capacity of soils.

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