

Cane Characteristics of ‘Cola II’ Red Raspberry as Affected by Application of Nitrogen Fertilizers and Organic Manure

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Abstract

This research was conducted to evaluate the effect of nitrogen amount and application time, and the effect of sheep manure application on the cane characteristics of ‘Cola II’ red raspberry. 56 and 112 kg.ha⁻¹ of N were applied as ammonium nitrate. The 112 kg.ha⁻¹ of N was applied as whole and split applications. Organic manure as 30 and 40 ton.ha⁻¹ was applied as whole applications as sheep manure. However, it had no effect other characteristics. Time of N application affected some of the characteristics measured. Yield increased significantly half/spring rates and fruit weight 30 ton.ha⁻¹ rate organic manure. Berry weight varied from 1.77 to 2.16 g, yield from 329.87 to 1009.6 g/m².

Key words: *Rubus idaeus* L., Tokat province, N fertilizer, organic manure

INTRODUCTION

Raspberries have been grown and consumed for years in the world, although they are new for Turkey. Raspberry cultivars may be classified either as berry color or fruiting habit. Raspberries may also be classified as summer-bearing (floricane fruiting) or everbearing (fallbearing). Summer-bearing cultivars produce one crop in early summer (primocane), while everbearing cultivars can produce up to two crops a year, one crop is being produced in the summer (floricane) and the second crop in the fall (primocane). In midsummer, the end of the harvest, all floricanes that bore fruit should be removed. These old canes (floricane) will die in the following winter since the canes of raspberries are biennial. In summer-bearing cultivars, the first year canes (primocane) grow from a shoot starting from the root. The second year these canes (floricane) bear berries and then die [1, 2].

Nitrogen fertilizer is an important fertilizer input in raspberry and blackberry production. Many researches have focused on its effect on growth and yield. Where yields were increased by N and K, postharvest quality response varied. However, work on N partitioning in ‘Chester Thornless’ blackberry demonstrated that the fruit was the strongest sink for newly applied N fertilizer in plant [3].

In general, it is assumed that only 50% of the nitrogen in most manure or compost will be available during the year of application (The availability of nitrogen in fresh poultry manure may be closer to 90% in the first year). However, the remaining nitrogen will become available in subsequent years and should be credited accordingly [4]. The for need large amounts of organic matter added to the soil for maximum bramble production cannot be stressed enough. Nine to ten tons of manure can be added per acre each year. Even though the

manure will provide nitrogen to the crop, 30 to 40 pounds (15-20 kg) of nitrogen should still be broadcast in late March [5].

The objective of this work was to determine the effect of N amount and timing of application cane characteristics of ‘Cola II’ red raspberry (*Rubus idaeus* L.) cultivar.

MATERIALS AND METHODS

This study was carried out of research and experimental area of Horticultural Department of, Agricultural Faculty Gaziosmanpasa University, Tokat, Turkey (39°52'- 40°55' N, 35°27'- 37° 39' E, elevation 585 m) in 2004. Some climatic data for the research area were presented in Table 1.

Soil samples were collected from 0-20 cm depth. Organic matter was determined by Wajkley-Black method as suggested by Black [6]. The experimental area soil is slightly alkaline (pH 7.79), medium in calcium carbonate (11.9%), poor in P (2.06 mg P₂O₅ 100 g⁻¹ soil), rich in K (28.7 mg K₂O 100 g⁻¹ soil) and poor in organic matter (1.47 %). The characteristic of experimental organic manure (OM) as sheep manure is alkaline (8.21), rich in N content (9.34 %), poor in P content (%1.79), rich in K content (84.47 mg K₂O 100 g⁻¹ soil) and rich in organic matter (55%).

A randomized complete block design with three replications was adapted four N treatments: 1) 0 N as a control (N0); 2) 56 kg.ha⁻¹ applied as a single spring application in late March (N1); 3) 112 kg.ha⁻¹ as a single spring application in late March (N2); and 4) 112 kg.ha⁻¹ applied in split application, with equal portions in late March and late June (N3). Ammonium nitrate was the N source (26% N) applied near the base of the canes in 2004. Otherwise applied at 30 ton.ha⁻¹ (OM₁) or 40 ton.ha⁻¹ (OM₂) dry sheep manure (before planting in late winter) in single applications. The seedlings of red raspberry cv. Cola II (a year-old) were planted on March, 2004.

Mean fruit weight (g) and seed ratio (%) of 90 berries were determined. The fruits were harvested two or three times a week. Yield data were obtained as g/m². Plant characteristics were examined during the dormant period. The cane diameter (primocane or summer cane) was measured 5 cm and 50 cm above ground in dormant period. Mean primocane length and diameter were measured as recommended by Davidson [7].

Data were analysed with analysis of variance (Anova) procedures using the SAS Statistical Software Package [8]. The means for N amount and organic manures applications were grouped based on LSD test. Results in all statistical calculations were considered to be significant for *P*-values < 0.05.

Table 1. Climatic data for the experimental area in the year 2004* in Tokat-Turkey

Month	Temperature (°C)			Rainfall (mm)
	Min.	Max.	Mean	
April	-8.3	30.5	11.3	32.0
May	0.7	30.1	14.9	48.0
June	6.5	32.4	18.7	27.2
July	7.0	36.2	20.6	0.4
August	9.9	36.4	21.9	4.8
September	1.1	33.3	16.8	0.0
<i>Mean Total</i>	<i>16.9</i>	<i>198.9</i>	<i>104.2</i>	<i>112.4</i>

*: The meteorological station of general directorate of rural services (the elevation is 585 m)

RESULTS AND DISCUSSION

The effect of N amounts on mean berry weight and yield were significant. The highest mean berry weight and yield of 2.16g and 1009.6 g/m², were obtained with the rate of OM₁ and half/spring of N, respectively (Table 2). No significant difference was observed among the application methods. No significant difference observed among the the application methods.

Among N and OM treatments, no significant effect was on seed ratio (means ranged from 5.57 % to 6.64%). Fruit weight and yield from OM₁ treatment were significantly higher than the control, full/split of N treatment affected berry weight (Table 2). Timing of N application which did not affect the yield. Similar results were reported by Clark and Watson [9] and Naraguma *et al.* [10].

Cane characteristics were presented in Table 3. The largest cane diameter was in OM₂ treatment with 7.32 mm. Cane height ranged from 74 cm (for OM₂ treatment) to 41.59cm (for control). Our results were in agreement with those reported by Hart *et al.* [10]. In generally, excess N adversely affects yield and also can promote vigorous vegetative growth. Based on the guideline from Games and Zebart [12], nitrogen application rate should be between 50 and 75 kg.ha⁻¹ under the soil conditions of medium organic matter (< 4% organic matter), and medium to moderately coarse to medium (silty loam to sandy clay loam).

Good nitrogen management in raspberries makes good agronomic and economic sense. Application of little nitrogen in lower amounts can result in reduced yield, reduced crop vigour and possibly reduce the life expectancy of the crop

stand. However, applying too much nitrogen in excess amounts which means unnecessary input costs, may result in increased disease incidence and reduced crop quality. High nitrogen levels may also interfere with fruit set and dormancy. Over application of nitrogen can also impact the environment. In most cases important amount of nitrogen remaining in the soil in the fall is washed out of the root zone over the fall and winter [12].

CONCLUSION

The results of this study show that 56 kg N. ha⁻¹ and OM₁ significantly increased yield compared to other applications in 'Cola II' red raspberry. OM₁ application was adequate for increasing both berry weight and yield. Results suggested that amounts rates of 56 kg N. ha⁻¹ or 30 ton OM.ha⁻¹ may be used, in cv. 'Cola II' red raspberry growing in Tokat conditions.

Table 2. Effect of amount and timing of application of N fertilizer and organic manure on some cane characteristics of Cola II red raspberry cultivar in Tokat, Turkey

Variable	Berry weight (g)*	Yield (g/m ²)**	Seed ratio (%)
N-application ^x			
N0-None (Control)	1.83 b	419.95 c	5.57
N1-Half/spring	1.88 b	1009.60 a	5.67
N2-Full/spring	1.85 b	857.60 b	6.04
N3-Full/split	1.94 ab	329.87 c	6.02
Organic manure ^y			
OM ₁ (full/winter)	2.16 a	962.00 ab	6.64
OM ₂ (full/winter)	1.77 b	920.50 ab	6.02

* Means with same letter in a column are not different at the p<0.05(*) and p<0.01(**)

^x Half application: 56 kg.ha⁻¹, full application : 112 kg.ha⁻¹

^y OM₁: 30 ton.ha⁻¹, OM₂: 40 ton.ha⁻¹

Table 3. Effect of rate and timing of application of N fertilizer and organic manure on some cane characteristics of Cola II red raspberry cultivar at Tokat, Turkey

Variable	Cane height(cm)*	Cane diameter(mm) ⁺	
		at 5 cm**	at 50 cm
N-application ^x			
N0-None (Control)	41.59 c	4.34 c	4.18
N1-Half/spring	52.02 bc	4.72 c	3.69
N2-Full/spring	54.83 bc	5.98 b	4.08
N3-Full/split	62.83 ab	6.54 ab	4.42
Organic manure ^y			
OM ₁ (full/winter)	61.19 ab	6.67 ab	4.08
OM ₂ (full/winter)	74.00 a	7.32 a	3.69

* Means with same letter in a column are not different at the p<0.05(*) and p<0.01(**)

^x Half application: 56 kg.ha⁻¹, full application : 112 kg.ha⁻¹

^y OM₁: 30 ton.ha⁻¹, OM₂: 40 ton.ha⁻¹

⁺ Cane diameter was measured over soil surface level

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