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Effect of Nitrogen (Farm Yard Manure + Urea) Treated Mulberry Trees on the Larval Development and Cocoon Weight of Silkworm, (*Bombyx mori* L.)

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Abstract: Silkworm larvae when fed on leaves from mulberry (*Morus laevigata*) tree given soil treatment with 2 kg well rotten F Y M along with 0.2%N concentration consumed more food, gained significantly more weight and produced heavier cocoons, as compared to those fed on leaves from trees treated with 2kg FYM + 0.1%N, 2kg FYM + 0.3%N, 2kg FYM + 0.4 %N and 2kg FYM alone.

Key words: *Morus laevigata*, farmyard manure, urea, *Bombyx mori* L., cocoon weight

Introduction

Silkworm (*Bombyx mori* L.) is a monophagous insect feeding on mulberry leaves only. Silkworm is one of the most beneficial domesticated insects. The development and growth of an insect is dependent as essential food elements. Therefore, the Scientists have experimented with supplementation of various nutrients on the mulberry leaves for feeding the Silkworm and promoting both silk quality and quantity. Ashfaq *et al.* (1998) found that silkworm larvae when fed on mulberry leaves treated with 0.2N + 0.05%Cu concentrations solution consumed more food, gained more larval weight and produced heavier cocoons as compared to untreated or other treated leaves. Ashfaq *et al.* (1998a) 0.2N + 0.1P + 0.05%Cu solution and (Ashfaq *et al.*, 1998b) 0.2N + 0.1P + 0.3K + 0.05%Cu solution, whose concluded that when larvae fed on these treated leaves consumed more food, gained more larval weight and produced heavier cocoons as compared to larvae fed on untreated or other treated leaves. Rasool (1995) concluded that larvae fed on leaves treated with 0.2N + 0.5%Mn concentrations solution, consumed more food, gained significantly more weight and produced heavier cocoons as compared to those fed on other treated or untreated leaves. Zaman (1995) resulted that silkworm larvae when fed on leaves treated with 0.15Mg + 0.2%N concentrations solution consumed more food, gained more larval weight and produced heavier cocoons as compared with those fed on untreated leaves.

The present studies were aimed for observing the feeding effect of 2kg F Y M along with different "N" concentrations prepared from Urea 46% and 2 kg F Y M alone applied to mulberry trees, through soil application at ten days interval with irrigation, on cocoon weight.

Materials and Methods

The Eggs of Korean strain, F₁ Hybrid (JAM 108 X JAM 107) of Silkworm, *Bombyx mori* L. were procured from Punjab Forest Department, Lahore. Eggs were placed for hatching during the last week of February in the growth chamber at 28 ± 2 °C and 70-80 % relative humidity. Soon after hatching, silkworm larvae were divided into six groups including check, following Randomized Complete Block Design (RCBD) with three replications and each replication had thirty larvae. Two kg well rotten Farm Yard Manure (F Y M) along with Urea 46% in different "N" concentrations, 0.1, 0.2, 0.3, 0.4% and two kg well rotten F Y M alone were applied at ten days interval through irrigation to five sprouted mulberry trees of two years age growing in the Entomological Experimental Area, University of Agriculture, Faisalabad. The treatments were as follows,

T ₁	2 kg well rotten F Y M + 0.1 % N
T ₂	2 kg well rotten F Y M + 0.2 % N
T ₃	2 kg well rotten F Y M + 0.3 % N
T ₄	2 kg well rotten F Y M + 0.4 % N
T ₅	2 kg well rotten F Y M alone
T ₆	Check

The first and second instar larvae were fed on chopped green leaves while the remaining three instars were fed on whole green leaves plucked from trees which received different treatments. Food was supplied to larvae twice a day first at 8.00 am and then at 8.00 pm and was continued till the larvae were fulfed and ready for pupation. Thirty larvae of each group were separately reared in 10X10 cm² sized Eighteen cardboard trays upto third instar while fourth and fifth instar larvae were reared in 10X20 cm² cardboard trays (Ashfaq *et al.*, 1998a; Ashfaq *et al.*, 1998b; Akram *et al.*, 1993; Nabila *et al.*, 1993; Shafiq and Haq, 1993; Mahmood *et al.*, 1989). The larval

weight was recorded on the last day of each instar using electronic balance. The residual leaves and feces were collected separately and dried in the oven at 100°C for 24 hours. The food consumption was measured by subtracting the dry weight of residual leaves directly from the determined total dry weight of leaves offered to silkworm. Cocoon weight with and without pupae under different treatments was also recorded. The data were analyzed statistically and Duncan's multiple range (DMR) test was applied to test the significance of results (Steel and Torrie, 1981).

Results and Discussion

Food Consumption: The first instar *Bombyx mori* larvae maximum consumed average food 14.49 mg larva⁻¹ when fed on mulberry leaves obtained from tree treated with 2kg F Y M + 0.2%N. Similarly, larvae consumed average food 14.01, 13.86, 13.69, 13.53 and 13.41 mg larva⁻¹ when fed on leaves from trees received 2kg F Y M + 0.1%N, 2 kg F Y M + 0.3%N, 2kg F Y M + 0.4%N, 2kg F Y M alone and untreated, respectively. The maximum average quantity of food consumed in the second, third, fourth and fifth instars was 27.83, 85.08, 725.93 and 4408.69 mg larva⁻¹ when *Bombyx mori* larvae fed on mulberry leaves obtained from tree treated with 2kg F Y M + 0.2%N (T₂), respectively as against larvae consumed minimum average food 14.39, 68.98, 445.61 and 2808.23 mg larva⁻¹ when fed on leaves from tree received no treatment (T₆). The average food consumption trend in all other treatments in all rest of instars were similar to first instar (Table 1). However, T₂ was considered the best treatment among the remaining treatments. Thus the research findings are in agreement with the work of Ashfaq *et al.* (1998) who found that silkworm larvae when fed on mulberry leaves treated with 0.2N + 0.05%Cu solution consumed more food as compared to untreated leaves. Similar studies were also carried out by Ashfaq *et al.* (1998a) 0.2N + 0.1P + 0.05%Cu solution, (Zaman, 1995) 0.15Mg + 0.2%N solution, (Tariq, 1993) 0.2N + 0.05P + 0.1K + 0.1% Ca solution, (Rasool, 1995) 0.2N + 0.5%Mn solution, (Ishtaiq and Akhtar, 1992) 0.2N + 0.1Ca + 0.1%K solution, (Ashfaq *et al.*, 1998b) 0.2N + 0.1P + 0.3K + 0.05%Cu solution, (Akram *et al.*, 1993) 0.3%Ca solution and Nabila *et al.* (1993) 0.3%N solution, whose concluded that when larvae fed on these treated leaves consumed more food as compared to larvae fed on untreated or other treatments. Similarly, Shafiq and Haq (1993), Liaw and Shikata (1980) whose reported that feeding silkworm larvae on top, young and tender leaves, are usually rich in "N" consumed better food than when fed on coarse and old leaves which are low in "N". Mahmood *et al.* (1989) found that *Bombyx mori* larvae fed on 0.2%N concentration, consumed more food, as compared to those larvae fed on leaves treated with 0.1N, 0.3N, 0.4%N concentrations both in wet and dry conditions.

Larval weight: First instar *Bombyx mori* larvae maximum gained in average weight 4.11 mg larva⁻¹ when fed on mulberry leaves fetched from tree treated with 2kg F Y M + 0.2%N. Similarly, larvae gained in average weight 3.99, 3.86, 3.79, 3.63 and 3.35 mg larva⁻¹ when fed on leaves from trees received 2kg F Y M + 0.1%N, 2kg F Y M + 0.3% N, 2kg F Y M + 0.4%N, 2kg F Y M alone and untreated, respectively. The maximum gained in average weight in the second, third, fourth and fifth instars was 13.76, 63.56, 348.92 and 1179.17 mg larva⁻¹ when *Bombyx mori* larvae fed on mulberry leaves fetched from tree treated with 2kg F Y M + 0.2% N (T₂), respectively as against minimum larvae gained in average weight 12.03, 45.20, 254.72 and 718.22 mg larva⁻¹ when fed on leaves fetched from untreated tree (T₆). The gained in average weight trend in all other treatments in all rest of four instars were similar to first instar (Table 2).

Mahmood *et al.*: Effect of Nitrogen on the cocoon weight of silkworm

Table 1: Effect of FYM + different "N" concentrations on average food consumption of silkworm

Treatments	Average food consumption (mg)				
	1 st instar	2 nd instar	3 rd instar	4 th instar	5 th instar
2Kg F Y M + 0.1%N	14.01a	24.75b	83.65a	698.08b	4376.89b
2Kg FYM + 0.2%N	14.49a	27.83a	85.08a	725.93a	4408.69a
2Kg FYM + 0.3%N	13.86a	23.22b	82.67a	660.00c	4352.32b
2Kg FYM + 0.4%N	13.69a	22.85b	81.94a	640.70c	4345.83 bc
2Kg FYM	13.53a	22.67b	81.16a	596.19d	4299.18c
Check	13.41a	14.39c	68.980b	445.61e	2808.23d

Values followed by same letters do not differ significantly at 5% level of probability

Table 2: Effect of F Y M + different "N" concentrations on average gained in silkworm, weight

Treatments	Average larval weight (mg)				
	1 st instar	2 nd instar	3 rd instar	4 th instar	5 th instar
2Kg FYM + 0.1%N	3.99b	13.34b	60.21b	343.61b	1158.02b
2Kg FYM + 0.2%N	4.11a	13.76a	63.56a	348.92a	1179.17a
2Kg FYM + 0.3%N	3.86c	13.31b	56.31c	318.30c	1149.36c
2Kg FYM + 0.4%N	3.79c	13.29b	55.71d	309.75d	1141.99d
2Kg FYM	3.63d	12.21d	54.76e	268.06e	1050.38e
Check	3.35e	12.03e	45.20f	254.72f	718.22f

Values followed by same letters do not differ significantly at 5% level of probability.

Table 3: Effect of F Y M + different "N" concentrations on average cocoon weight of silkworm

Treatments	Characteristics	
	Average cocoon weight with pupa (mg)	Average cocoon weight without pupa (mg)
2kg FYM + 0.1% N	394.10b	211.73b
2kg FYM + 0.2% N	400.48a	222.41a
2kg FYM + 0.3% N	390.64c	207.75c
2kg FYM + 0.4% N	383.47d	204.88d
2kg FYM	379.53e	198.99e
Check	267.36f	137.75f

Values followed by same letters do not differ significantly at 5% level of probability.

However, T₂ was considered the best treatment among the remaining treatments. The present findings tally with Ashfaq *et al.* (1998) found that silkworm larvae when fed on mulberry leaves treated with 0.2N + 0.05%Cu solution gained significantly more weight as compared to untreated leaves. Similarly, Ashfaq *et al.* (1998a), 0.2N + 0.1P + 0.05%Cu solution, (Zaman, 1995) 0.15Mg + 0.2N solution, (Tariq, 1993) 0.2N + 0.05P + 0.1K + 0.1%Ca solution, (Rasool, 1995) 0.2N + 0.5%Mn solution, (Ishtaiq and Akhtar, 1992) 0.2N + 0.1Ca + 0.1%K solution, Ashfaq *et al.* (1998b) 0.2N + 0.1P + 0.3K + 0.05%Cu solution, (Akram *et al.*, 1993) 0.3%Ca solution and Nabila *et al.* (1993) 0.3%N solution, whose concluded that when larvae fed on these treated leaves gained significantly more weight as compared to fed on leaves received from untreated or other treatments. Similar studies were also carried out by Shafiq and Haq (1993), Liaw and Shikata (1980) reported that feeding silkworm larvae on top, young and tender leaves, are usually rich in "N" resulted in better larval development than when fed on old and coarse leaves which are low in "N". Javaid (1991) concluded that mulberry leaves treated with 0.3K + 0.2%N gave best result for the larval development. The results are in agreement with Mahmood *et al.* (1989) found that 0.2%N concentration, *Bombyx mori* larvae gained significantly more weight as compared to the larvae fed on leaves treated with 0.1N, 0.3N, 0.4%N concentrations both in wet and dry conditions.

Cocoon weight: The average maximum cocoon weight with pupa was 400.48 mg larva⁻¹ and without pupa was 222.41 mg larva⁻¹ when it fed on 2kg F Y M + 0.2%N treated leaves as against 394.10, 390.64, 383.47, 379.53 and 267.36 mg larva⁻¹ with pupa; 211.73, 207.75, 204.88, 198.99 and 137.75 mg larva⁻¹ without pupa in case of 2kg F Y M + 0.1%N, 2kg F Y M + 0.3%N, 2kg F Y M + 0.4%N, 2kg F Y M alone and untreated, respectively. Thus the effect of 2kg F Y M + 0.2%N treatment (T₂) differed from all other treatments including check (Table 3). Present findings are in the line of Ashfaq *et al.* (1998) who found that silkworm larvae when fed on mulberry leaves treated with 0.2N + 0.05%Cu solution produced heavier cocoons as compared to untreated leaves. Similar, studies were also carried out by Ashfaq *et al.* (1998a), 0.2N + 0.1P + 0.05%Cu solution, (Zaman, 1995) 0.15Mg + 0.2%N solution, (Tariq, 1993) 0.2N + 0.05P + 0.1K +

0.1%Ca solution, (Rasool, 1995) 0.2N + 0.5%Mn solution, (Ishtaiq and Akhtar 1992) 0.2N + 0.1Ca + 0.1%K solution, Ashfaq *et al.* (1998b) 0.2N + 0.1P + 0.3K + 0.05%Cu solution, (Akram *et al.* (1993) 0.3%Ca solution and Nabila *et al.* (1993) 0.3%N solution, whose concluded that larvae when fed on these treated leaves produced heavier cocoon weight as compared to larvae fed on leaves of untreated or other treatments leaves. Similarly, Shafiq and Haq (1993), Liaw and Shikata (1980), Askari and Sharan (1982) and Tulog and Catli (1983) whose reported that feeding silkworm larvae on top, young and tender leaves, are usually rich in "N" resulted in more cocoon weight than when fed on old and coarse leaves which are low in "N". Javaid (1991) concluded that mulberry leaves treated with 0.3K + 0.2%N gave best result for cocoon weight larva⁻¹. Mahmood *et al.* (1989) found that 0.2%N concentration produced heavier cocoons as compared to the larvae fed on leaves treated with 0.1N, 0.3N, 0.4%N concentrations both in wet and dry conditions. Haq and Saleem (1985) found that feeding of mulberry leaves treated with 0.2%N concentration significantly increased the cocoon weight as compared with those fed on untreated leaves and treated with 0.1N and 0.4%N concentrations. Krishnaswami *et al.* (1971) reported that soil application of "N" significantly improved cocoon weight.

The silkworm larvae gave responded to mulberry leaves of the treated trees. However, 2kg F Y M + 0.2%N (T₂) was the best treatment due to which the highest larval and cocoon weight was recorded.

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