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Mulberry seedling characteristics and germination rate under the influence of different manures

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Abstract
Because of financial wellbeing, fertiliser enhancement has become a pressing concern around the world. Similarly, the harmful effects of chemical fertilisers on soil quality and the threats they pose to the ecosystem. The experiment was conducted at CoTS, Mirgund, SKUAST-Kashmir to investigate the effects of various manures on seedling parameters and germination rate. The study confirmed that Duckweed outperformed the other manures in terms of germination rate (0.088), seedling survival rate (22.6 percent), and Dickson's quality score (0.08). Seedling height, leaves per seedling, shoot weight and seedling vigour index are found to be highest in the treatment receiving Duckweed. The insistence on Farmyard manure can be reduced by advertising the use of Duckweed manure throughout the farming community. Duckweed's use in the production of several crops, particularly mulberry, would significantly reduce pollution in the environment.

Keywords: Fertilisers, duckweed, dickson's quality score, seedling vigour index and farming community

Introduction
Mulberry leaves are the only food source for the silkworms that produce silk fibre. The success of silk industry depends on the availability of mulberry leaf. Silkworm, *Bombyx mori* L. is a silkworm that only eats mulberry leaves. The cultivation necessitates a high level of attention in order to produce a successful cocoon production. The mulberry plant is the foundation of the sericulture industry. The health of the silkworm larvae and their ability to produce silk is highly influenced by the quality of the mulberry leaf. Germination is a crucial stage in the plant's life cycle. Organic manures are nutrient storage factories (N, P, and K). Using organic manures to meet plant nutritional needs has become a common technique in recent years for sustainable agriculture and sericulture. The physical, chemical, and biological qualities of soil are all improved by organic manures. Because of its use in other sectors, such as horticulture and other agricultural products, as well as a fuel in rural regions, the most widely used manure in the sericulture sector is FYM, and its availability is not in tune with desired demand. As a result, alternative manures must be sought out. Seedling survival is a crucial metric for pursuing observations and achieving success in the experimental field. Seeding quality is influenced by the media composition (Wilson, 2013) [24]. As a result, a high survival rate is dependent on the nutrients available in various manures. The favourable effects of organic manures on the development of the root system boost the survival rate of seedlings (Abirami *et al.*, 2010) [1]. Dickson's quality index explains plant survival and development potential in the field. The higher the index value, the better (Olivo and Buduba 2006) [18]. As there is little information on these features in the Kashmir region. To address the high expense of chemical fertilisers, meet crop nutrient requirements from a single source, and improve soil health, integrated nutrient management employing organic sources such as farm yard manure, vermicompost, poultry manure, and neem cake has become necessary (Gayam Sujatha *et al.*, 2020) [26]. The purpose of this study was to determine how different manures affected the germination rate, survival rate, seedling vigour index, shoot weight, number of leaves, seedling height and Dickson's quality index of mulberry seedlings and finally it would help to reduce the dependence on fertilizers.

Methodology
Before planting, different manures were applied to the garden soil at a rate of hundred grams

Manure per two kilogrammes of medium, with the exception of poultry manure, which was put at a rate of fifty grams per two Kgs of medium. This is because poultry manure, when sprayed in large quantities, impacts seed germination by becoming harmful to the embryos of seeds and killing the seeds before they emerge (Sekar, 2010) [2]. Poultry dung also has a high nitrogen content, which causes it to burn (Ikpe and Powel, 2002) [11]. In each treatment, twenty-eight mulberry (*Morus* sp.) seeds were sown at a uniform depth of 0.5-1 cm with nearly similar spacing between the seeds (wani *et al*. 2019) [23]. The design used was CRD consisting of 4 replications and six treatments, Farm Yard Manure @ hundred grams, Duckweed @ hundred grams, Vermicompost @ hundred grams, Poultry manure @ fifty grams, Silkworm litter @ hundred grams, Control (without manure). Morning and evening, the bags were watered and placed in direct sunlight.

Fig 1: Mulberry seed being shade dried

Germination rate

The rate of germination was estimated using the formula proposed by Ellis and Roberts (1980) [8].

$$R = \sum n / \sum Dn$$

Where,

R represents germination rate, n represents number of seeds germinated in days, and D denotes the number of days since the start of the experiment.

Dickson's quality index (Q. I)

The assessment of made by using formula proposed by Dickson *et al*. (1960) [7].

$$\text{Dickson's quality Index (Q.I)} = \frac{\text{Dry weight of mulberry seedling(g)}}{[\text{Height(cm)/thickness(cm)}] + [\text{shoot weight(g)/root weight(g)}]}$$

Survival rate

It was computed by using the following formula

$$\text{Survival rate (\%)} = \frac{\text{No. of mulberry seedlings live}}{\text{No. of seeds sown}} \times 100$$

Seedling vigor index (SVI)

Estimated by SVI= Germination (%) x Seedling length (cm). The first day of sowing was chosen as the starting point, and the total number of seeds germinated on each subsequent day was counted and recorded. Five seedlings / treatment / replication were used to compute the average value (Abul-Baki and Anderson (1973) [28].

Seedling leaves

The leaves of seedlings were counted. Five measurements were used to calculate the mean of number of leaves.

Weight of Shoot (grams)

The shoot part of the seedlings was weighed using electronic balance.

Seedling height (cm)

The height (cm) of seedling was measured by scale (cm). Five observations were taken to calculate the average height of seedling.

Statistical analysis

The information gathered was assembled and statistically analysed using a method proposed by Gomez and Gomez (1984) [2]. At a 5% level of significance, the significance of 'F' and't' was examined. The "OP stat" software package was used to conduct the study. When the F test was confirmed to be significant with a 5% probability, crucial difference values were utilised to compare the treatment means.

Results and Discussion

T_2 (Duckweed) had the highest germination rate (0.088), which was statistically comparable to the 0.083 obtained in T_1 (FYM) and much higher than the other treatments (Fig 1). In T_6, control, it was the smallest (0.061) (Table 1). The type of manure in the seedling rearing medium had a significant impact on seed germination and subsequent growth and development of mulberry seedlings, according to the findings. The addition of organic manures increased germination and other growth metrics in general, which could be attributable to the favourable soil physical environment provided (Sarma and Gogoi, 2015) [19]. Duckweed outperforms other manures might be because of plenty of Brassinosteroids, which are involved in enzyme formation, increased nucleic acid content and soluble proteins, and decreased enzyme activity of RNAase, which is required for seed germination. According to Mahesh *et al*. (2013) [14], Brassinosteroids boosted germination rate in radish seeds by increasing nucleic acid and soluble protein levels while decreasing RNase enzyme activity. Another cause could be the easy rupturing of the endosperm and the boosting of the embryo's development capacity by Brassinosteroids. T_2 (Duckweed) had the highest survival rate of 22.6 percent, followed by T_3 (Vermicompost) and T_4 (Silkworm litter), while control had the lowest survival rate (Fig 2). This could be due to Duckweed's high nutritional

content when compared to other manures. The enzymatic activities increased as a result of the high proportion of nutrients in the manure, resulting in higher protein synthesis and improved seedling performance (Zhao and Liu, 2009) [25]. The findings are consistent with those of Trubat *et al*. (2008) [22], who found that survival rates are strongly dependent on the species and dietary conditions. The greatest value of Dickson's quality index was 0.08 in T_2 (Duckweed), followed by T_3 (Vermicompost), T_4 (Silkworm litter), and T_5 (Silkworm litter), and the lowest value was observed in control (Fig 3). This could be attributed to Duckweed's higher organic matter content than the other manures. Organic matter may have boosted the soil's water holding capacity, resulting in healthier and more robust seedlings with superior quality metrics (Olivo and Buduba, 2006; Manas *et al*. 2009) [8, 15]. The findings are consistent with Oliet *et al*. (2009) [1], who found that plants develop more rapidly in soils rich in organic matter.

T_2 (Duckweed) had the highest seedling height (17.50 cm), significantly higher than the other treatments. T_6 (control) had the shortest seedling height, measuring 7.35 centimetres. T_2 (Duckweed) had the maximum number of leaves per seedling (12.30), which was substantially higher than the other treatments. T6 once again had the lowest number of leaves per seedling (6.40). (Control). T_2 (Duckweed) had the highest dry shoot weight (1.85 g), which was significantly greater than T_1, T_3, T_4, T_5, and T_6 (control). T_6 has the smallest amount of shot weight (0.48 g) (control). T_2 (Duckweed) had the highest seedling vigour index (1515.50), which was significantly greater than T_1, T_3, T_4, T_5, and T_6 (control). The seedling vigour index had the lowest value (432.92) in T_6 (control). Mulberry seedlings treated with organic manures had superior shoot parameters than those raised without.

According to Hedge, manures (FYM, sheep manure, chicken dung, and compost) have been found to promote soil health (1997). The feasibility of transforming garbage into nutrient-rich manure as a viable mulberry manure was investigated by Das *et al*. (1997) [5]. Organic manures improve soil health and protect the environment, according to Gupta *et al*. (2005) [9], by providing important micronutrients and also establishing soil micro flora, which is involved in nitrogen fixation. The superiority of Duckweed over other manures in enhancing mulberry seedling characteristics could be attributed to its high holding capacity and nutrient availability. Dal weed, according to Mugloo *et al*. (2010) [16], has a higher availability of nutrients and moisture, both of which are necessary for plant establishment and growth. Duckweed may have a better supply of nutrients during the early stages of seedling growth, resulting in more leaves per seedling and hence more photosynthates formed in the leaves, leading in enhanced seedling thickness and dry shoot in mulberry seedlings. Decomposed aquatic weed improves plant health by increasing leaf production in grapes (Colapietra and Alexander (2006) [4]. Weed in decomposed form improves seedling emergence, germination percentage and rate, and seedling vigour index in a variety of crops, providing a better environment for shoot growth and seed germination, as well as a higher percentage of seedling survival than other manures (Demir *et al*. (2006) [6]. Duckweed also provides a favourable environment for a range of microorganisms, which may have contributed to the increase in vigour index through their different activities. Azospirillum, Pseudomonas, and Azotobacter strains discovered in Duckweed.

Table 1: Impact of different manures on germination, survival rate and Dickson's quality index of mulberry seedlings

Treatment	Germination rate	Survival rate (%)	Dickson's quality index
T_1 @ 100g	0.083	19.6±0.30	0.06±0.003
T_2 @ 100g	0.088	22.6±0.80	0.08±0.002
T_3 @ 100g	0.068	21.6±0.87	0.07±0.001
T_4 @ 50g	0.080	20.0±0.57	0.07±0.002
T_5 @ 100g	0.070	21.0±0.57	0.07±0.003
T_6 (C)	0.061	11.5±0.20	0.04±0.002
CD ($p \leq 0.05$)	0.006	2.60	0.014
SEm±	0.002	0.90	0.005
C.V.%	5.695	7.51	12.5

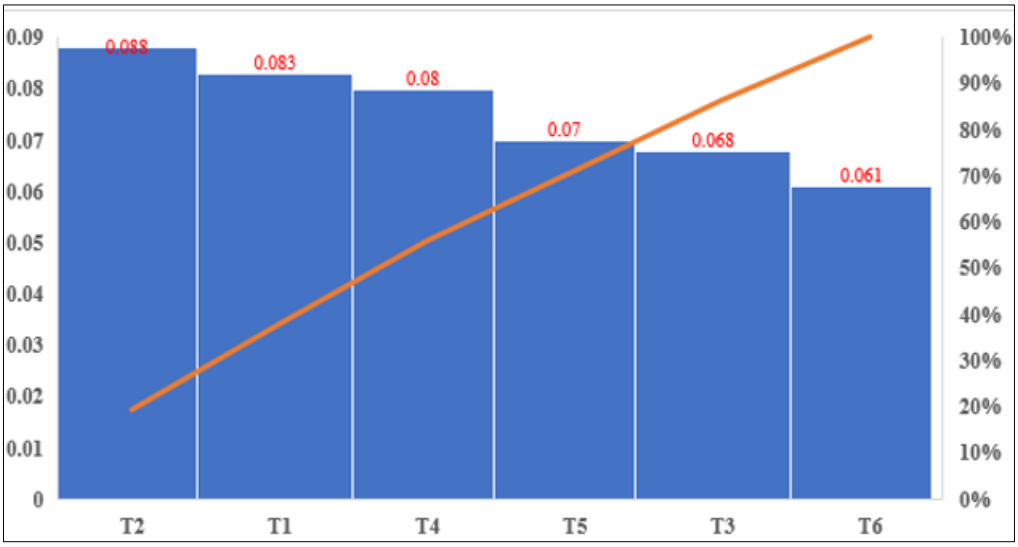

Fig 1: Germination rate of mulberry seed

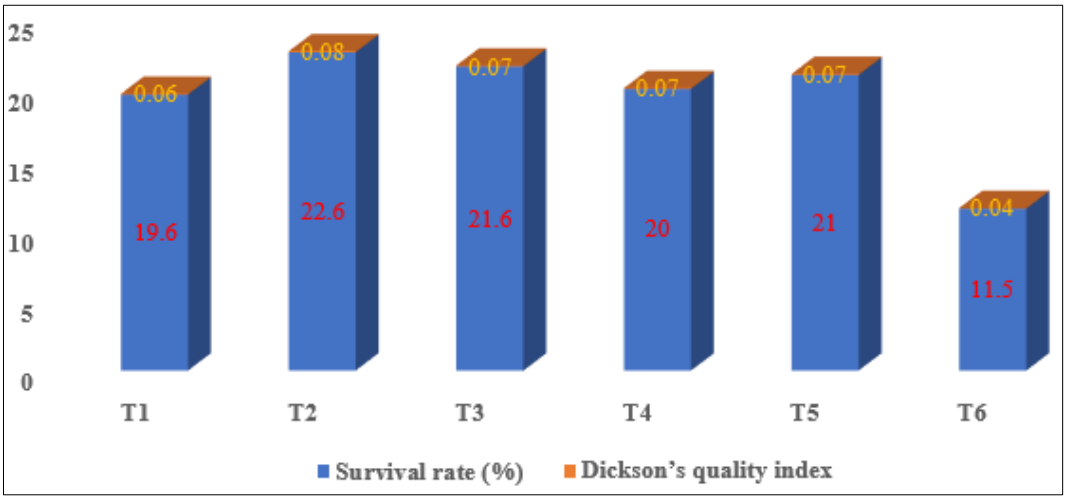

Fig 2: Seedling parameters under different manures

Fig 3: Seedling parameters under various manures

Where,
DW: Duckweed, PM: Poultry Manure, SL: Silkworm matter, VC: Vermicompost, FYM: Farm Yard Manure and C: Control

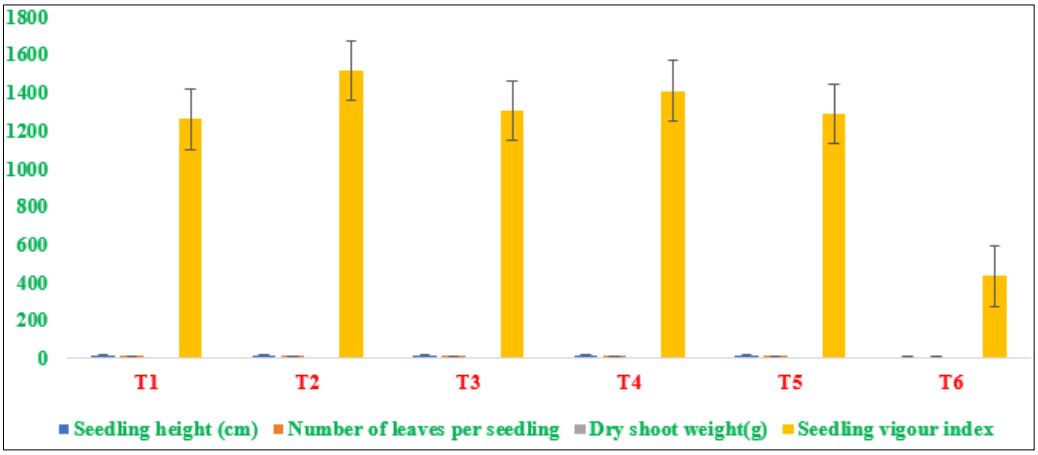

Fig 4: Shoot parameters of mulberry seedlings in different manures

Concluding remarks

Different manures influence mulberry seed germination, and Duckweed was found to be the best manure for mulberry seed germination. The Duckweed treatment also improved seedling characteristics such as survival rate and Dickson's quality score. As a result, the study demonstrated the utility of Duckweed in comparison to farmyard manure and other manures. Furthermore, there is abundant of this weed in Kashmir's famous Dal Lake, and adding it into Sericulture/Agriculture/Horticulture would alleviate the

burden on other manures and on chemical fertilizers. The insistence on Farmyard manure can be reduced by advertising the use of Duckweed manure throughout the farming community. Duckweed's use in the cultivation of several crops, including mulberry, would also benefit the environment.

Recommendation

Duckweed is best manures among the other manures tested in the study, hence can be recommended for farming community.

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Interests at odds

There are no competing interests stated by the authors.

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