Effect of Different Shade Levels on Growth and Tuber Yield of Turmeric (Curcuma longa L.) In the Batticaloa District of Sri Lanka

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Abstract: An experiment was conducted to evaluate the growth and development of turmeric under four different shade levels at Crop Farm, Faculty of Agriculture, Eastern University, Sri Lanka from September 2014 to March 2015. Treatments consist of, open field condition (T1) which was considered as 0% shade level, 50% shade level (T2), 70% shade level (T3) and 80% shade level (T4), were evaluated in completely randomized design. Agronomic practices were followed according to the recommendations of Department of Export Agriculture, Sri Lanka. Leaf area and plant biomass were measured bimonthly and yield was quantified at the end the experiment. Analysis of Variance was performed to determine significant differences among treatments (P < 0.05). Results indicated that leaf area, biomass and yield were significantly higher in T2 followed by T3 than T1. Higher radiation level would have caused destruction of photosynthetic pigments and hence reduction in growth. In the treatments of T3 and T4, the amount of solar radiation received by the plants are not sufficient for optimum photosynthesis. Therefore, it could be concluded that 50% shade level is suitable for the cultivation of turmeric in the Batticaloa district of Sri Lanka.

Key words: Biomass - Leaf area - Shade Levels - Tuber Yield - Turmeric

INTRODUCTION

Turmeric (Curcuma longa L.) is a popular spice crop in Sri Lanka containing curcumin, which has several medicinal values. The healing ability of turmeric has long been recognized by traditional medicine practitioners. Western scientists identified evidences claims that turmeric acts as an anti-cancer agent [1]. Turmeric is traditionally used to prepare curry mixes in many Asian countries. In addition turmeric is widely used in cosmetic industries, too. Therefore, demand for turmeric continuously increasing in Sri Lanka and turmeric cultivation is a profitable agribusiness.

An important ecological factor to be considered to any cultivated species is the best irradiance level [2]. Shade levels influence the growth and tuber yield of turmeric. Turmeric grows well under partial shade however; higher shades affects yield adversely [3]. However, the effect of different shade levels on the growth and productivity of turmeric has not been adequately studied and there is no recommended shade level for turmeric cultivation in Batticaloa district.

As such this experiment was conducted with the objectives of, to compare the effect of different shade levels on growth and yield of turmeric and to find out the optimum shade level for turmeric cultivation in the Batticaloa district of Sri Lanka.

MATERIALS AND METHODS

This experiment was conducted at the Crop Farm, Eastern University, Sri Lanka from September 2014 to March 2015. Uniform weight (40-50 g) rhizomes of turmeric (Var. Local) with 1 to 2 buds were planted in raised beds at a spacing of 30 cm × 25 cm.

The treatments were arranged in a completely randomized design with three replications. Each replication contained thirty plants and an experimental unit consisted of one plant. The treatments were defined as follows:

Treatment 1 (T1) - Open field (Control)
Treatment 2 (T2) - 50% shade level
Treatment 3 (T3) - 70% shade level
Treatment 4 (T4) - 80% shade level

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All the crop management practices were followed uniformly for all treatments based on the recommendations of Department of Export Agriculture, Sri Lanka. Destructive sampling method was practiced and samples were selected randomly for measurements. Leaf area (cm²) and plant biomass (g) were measured bimonthly and yield was quantified at the end of the experiment. Analysis of Variance was performed to determine significant differences among treatments (P < 0.05) using Statistical Analysis Software (SAS) Version 9.1.

RESULTS AND DISCUSSION

Leaf Area per Plant: Leaf area per plant (LA) of turmeric was significantly (p<0.05) influenced by different treatments (Fig. 1). Plants grown under 50% and 70% shade levels produced higher LA than other treatments. Significantly highest LA was produced under 50% shade level at 3 months after planting (MAP).

Growth of crops is interrelated to the amount of solar radiation received during the growing period [4]. Crop growth was suppressed by reduced radiation levels. LA is also influenced by different shade levels.

In 80% shade level, LA was significantly lower than 50% and 70% shade levels and LA reduced with time. It showed that radiation received by the plants was below their requirement. Plants grown in open field (T1) developed significantly lowest LA than other treatments. It showed that shading is important for the growth and development of LA of turmeric plants. Leaf of turmeric under shade condition grew more than those in the open field. Growth parameters of turmeric were increased with decreasing light levels [5]. Leaves of turmeric might be sensitive to higher irradiation levels. Higher radiation level would have caused destruction of photosynthetic pigments and reduction of growth. It could be the reason for reduction of leaf area under open field conditions. Leaves of dracaena could be sensitive to higher irradiation levels, which would have caused destruction of photosynthetic pigments [6].

The shade level of 50% seemed to be preferable for optimum growth of LA of turmeric in Batticaloa district of Sri Lanka as the LA increased with time. This pattern of growth of LA was not seen in other treatments. It showed that 50% shade level provide sufficient amount of light for optimum growth of turmeric. Partial shade increased leaf area of turmeric [7].

Plant Biomass: Significant (p<0.05) differences were observed between different treatments in plant biomass (Fig. 2). Plants grown in 50% shade level produced highest biomass than other treatments. Significantly highest biomass was produced under 50% shade level at three months after planting.

Dry matter production was decreased with decreasing leaf area index [8]. Dry matter accumulation was decreased due to the decrease in leaves number and leaf area index [9]. Hence, lower LA in plants grown in open filed would have caused reduction in photosynthesis and thereby reduced dry matter accumulation.

In 70% and 80% shade levels, amount of solar radiation received by the plants may not be sufficient for the optimum photosynthesis. Therefore the biomass accumulation might be lower in treatments T3 and T4. Several studies [7] and [10] suggested that partial shading is important for optimum growth of turmeric. Thus 50% shade level seemed to be optimum for maximum accumulation of biomass in Batticaloa district of Sri Lanka.

Fig. 1: Effect of different shade levels on leaf area per plant of turmeric. Values are mean ± Standard Error (n=3)
Yield: Different shade levels significantly (p<0.05) influenced the yield of turmeric (Fig. 3). Significantly highest and lowest turmeric yield was recorded in T2 and T1, respectively.

Significantly lowest yield was obtained in T1. It may be due to reduced level of photosynthesis as the LA was lowest in T1 throughout the experiment. Biomass accumulation has significant effect on the tuber yield of turmeric. In T1, biomass production was at lowest level. This may also be contributed for lowest yield. Partial shade increased yield of turmeric [7, 10]. In 70% and 80% shade levels, amount solar radiation received by the plants may not be sufficient for the optimum photosynthesis. This would have caused reduced yield in treatments 3 and 4. The highest yield was obtained in 50% shade level. Thus 50% shade level could be optimum for maximum photosynthesis and biomass accumulation. Plant biomass and productivity are interrelated [11]. This might be the reason for the highest yield obtained in T2.

CONCLUSIONS

In this experiment, growth and yield performances of turmeric plants were better under 50% shade level. Therefore, it could be concluded that 50% shade level is suitable for the cultivation of turmeric in the Batticaloa district of Sri Lanka.

REFERENCES


