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Evaluation of an on-farm organic growing media on the growth and development of pepper seedlings

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Abstract

Adams Enterprises Ltd. has developed an on-farm organic media formulated from locally available agricultural materials such as rice straw and from an invasive aquatic weed in the Northeast of Thailand. Organic growers require an organic media growing mix of high quality to support the growth and development of seedlings in the nursery, prior to transplanting. Therefore, the objective of this study was to compare the growth and development of seedlings of a local pepper variety as affected by 3 growing media formulas developed from on-farm organic media and from commercially available organic and inorganic medias. This work presents data on height, leaf number, and on the growth rate index of seedlings prior to transplanting to the field. The results showed that our on-farm media has promise as an effective replacement to the use of commercial media sources. However, additional research is needed, to ensure that the on-farm media mix meets the proper uniformity and quality standards. This work was supported by Adams Enterprises as part of its effort to support extension programs for the small farm contracting system.

Keywords: on farm, organic media, seedling, pepper, stand establishment

Introduction

High quality media to raise seedlings for transplanting is a key determinant factor to establish a successful crop production program. Media that provides optimal water-holding capacity, sufficient nutrients and that is pathogen-free results in better seedling quality prior to transplanting (Evans, 1998). Several media mixtures have been evaluated to determine an

optimal formula to support seedling growth and development. Strawberry cv. Fern seedlings had the highest growth, leaf number, leaf area, fresh and dry root weight, root length and fresh weight when grown on 4-8 mm pumice grade and 45% pumice amendment with soil (Sahin et al., 2004). The use of two different composts, including aged grape marc + cattle manure, and aged grape marc + poultry manure, mixed with peat at 25-50% by volume showed that lettuce (*Lactuca sativa*), chard (*Beta vulgaris*), broccoli (*Brassica oleracea*) and coriander (*Coriandrum sativum*) had an improved germination rate and height compared to the use of pure peat because of the improved physical, physico-chemical and chemical properties of the composted materials (Bustamantem et al., 2008). Moreover, the addition of a low dose of aged mushroom substrate (SMS) to a mixture with peat provided adequate growth in courgette (*Cucurbita pepo* L. var. Afrodite F1) and pepper (*Capsicum annum* L. var. Lamuto F1) (Medina et al., 2009).

In Thailand, growers regularly use commercial peat moss as the major media for sowing seed. However, its quality is sometime inconsistent and its price is subject to sudden increases depending on the market situation. Therefore, an alternative media mixture using local materials should be considered to minimize production costs in the future. A mixture of decomposed water lettuce (*Pistia stratiotes*) and rice straw may be able to replace peat moss in the growing media. Hassan (2005) reported that a 30% addition of rice straw compost in tomato (*Lycopersicum Esculentum* L.) grown in a peat-based transplant media showed an increased plant dry biomass, fruit diameter, yields and water use efficiency. Adams Enterprises Ltd. has developed an on-farm organic media from locally available organic materials such as rice straw and from an invasive aquatic weed in the Northeast of Thailand. We found that the chemical properties of this organic media were comparable to that of commercial inorganic and organic medias as described in earlier studies (Amassa and Manenoi, 2008).
Therefore, this research was conducted to compare the efficiency of on-farm organic and conventional growing media on seedling growth and development. The results of this study will help Thai growers adopt the use of alternative growing media and to minimize the cost of production especially for organic farmers.

Materials and Methods

Local chili pepper seed (*Capsicum frutescens* Linn. cv. Hou Rua) were germinated by the paper method for 5 days. Germinated seeds were sown in plug trays with different growing media as follow:

Treatment 1: On-farm growing media

Methods: Decomposed water lettuce, chopped rice straw, and rice bran were mixed at a 95:4:1 ratio (w/w/w). Molasses and fruit/fish juices were added to activate the composting process. The mixture was maintained at an optimal humidity of 50-60 %. The media mixture was allowed to compost for at least 6 months.

Treatment 2: Commercial organic media.

The commercial organic media was comprised of peat moss without the addition of inorganic nutrients

Treatment 3: Commercial inorganic media.

The commercial inorganic media was comprises of peat moss with the addition of inorganic nutrients

Treatment 4: On farm organic media mixed with commercial organic media at a 1:1 ratio

Treatment 5: On farm organic media mixed with commercial organic media at a 2:1 ratio
Seedlings were raised for 2 weeks in plug trays in the nursery net house with a plastic sheet roof. The growth rate was randomly examined on 30 seedlings per treatment every 3 days. Stem height, growth index, number of leaves, and a seedling fertility index (4 levels: excellent, good, medium, poor) were investigated in this study. The study was repeated 2 times during June to July 2009 to minimize experimental errors from potential variable climatic condition.

Results and Discussion

The on-farm media alone or a mixture with commercial organic media at a ratio of 2:1 and 1:1 resulted in a significantly greater fertility of pepper seedlings than the other treatments (Figure 1, 2, 3 and 4). The first three treatments showed increased stem height, growth rate index, and leaf numbers after transplanting into plug trays (Figure 1. 2 and 3). In contrast, seedlings grown on commercial organic and inorganic medias had a significant delay in growth and development throughout the study (Figure 1, 2 and 3). Seedlings grown on the organic media mixed with commercial organic media at a 2:1 ratio showed a trend toward the highest growth rate but it was not significantly different to the seedlings grown with on-farm media alone and with a mixture of commercial media at a 1:1 ratio (Figure 1, 2 and 3). Earlier studies showed that the on-farm media had greater P and K levels than the commercial media (Amassa and Manenoi, 2008). Our results showing greater growth of tomato seedlings with the use nutrient rich composted media were also observed by other researchers, such as with the use of composted rice straw, poultry manure and banana waste mixed with peat moss, showing improved growth of tomato seedlings (Badran et al., 2007). Herrera et al. (2008) found that tomato (*Lycopersicum esculentum* Mill. cv. "Atletico") sown on 65% white peat (WP) mixed with 30% municipal solid waste compost (MSWC) had greater growth and quality yields than those grown with standard peat mixtures, old peat mixtures and with WP + MSWC mixtures that had a high proportion of MSWC. In this study, we found that a lack of available essential nutrients in the organic commercial media (Treatment 2) resulted in poor seedling growth. Our results were similar to the Mg and K deficiency symptoms observed on *Khaya ivorensis* seedlings which resulted in poor growth and lower nutrient tissue levels. (Jeyanny et al., 2009).

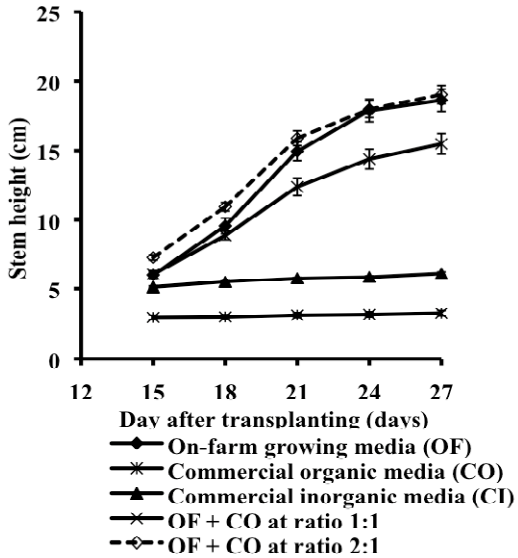

Figure 1: Stem height of chili pepper seedlings grown on different growing media. Significance determined at the 1% level ($P<0.01$). Data were analyzed by SAS. Mean Comparisons were determined by Duncan's New Multiple Range Test (DMRT).

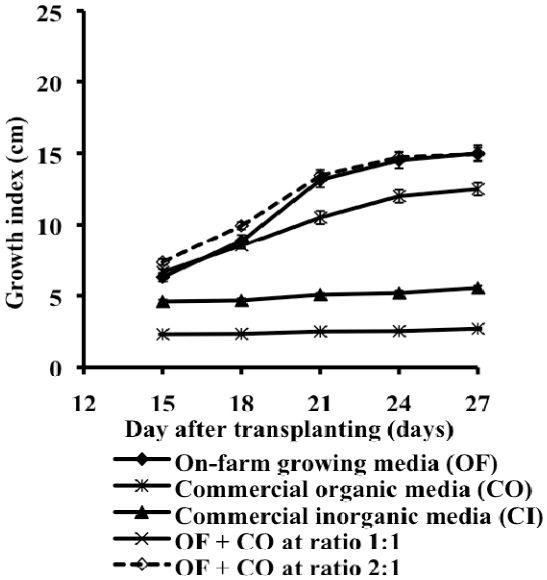

Figure 2: Growth index of chili pepper seedlings grown on different medias. Significance determined at the 1% level ($P<0.01$). Data were analyzed by SAS. Mean Comparisons were determined by Duncan's New Multiple Range Test (DMRT).

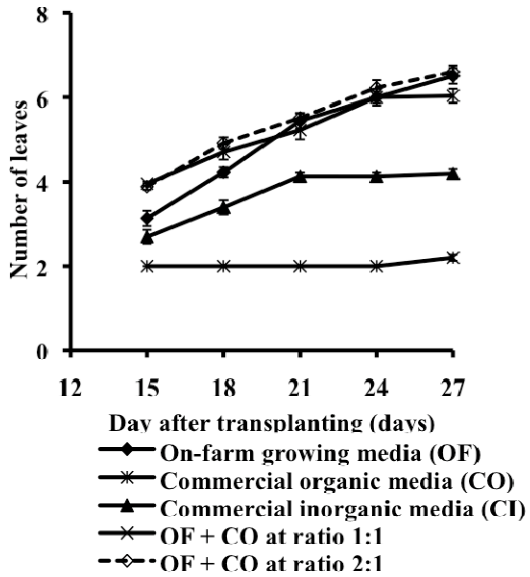

Figure 3: Number of leaves per plant of chili pepper seedlings grown with different growing medias. Significance determined at the 1% level ($P<0.01$). Data were analyzed by SAS. Mean Comparisons were determined by Duncan's New Multiple Range Test (DMRT).

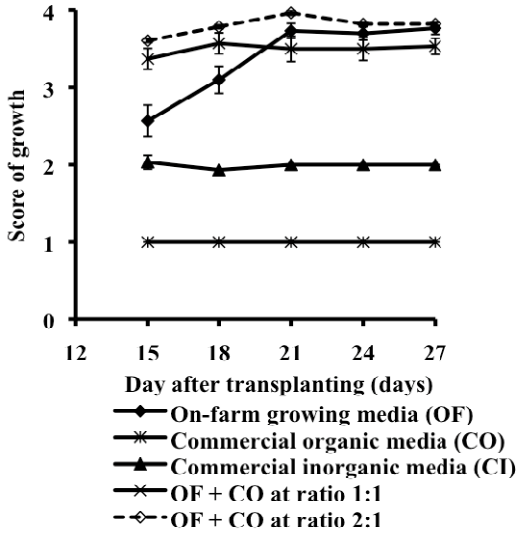

Figure 4: Score of growth of chili pepper seedlings grown with different growing medias. Significance determined at the 1% level ($P<0.01$). Data were analyzed by SAS. Mean Comparisons were determined by Duncan's New Multiple Range Test (DMRT).

Conclusions

The on-farm growing media mixed with the organic commercial media at a 2:1 ratio (w/w) resulted in enhanced chili pepper seedling growth and development compared to the other treatments. However, no significant differences were observed between seedlings grown with on-farm media alone and with the mixture of commercial media at a 1:1 ratio.
Therefore, our on-farm media produced by composting of natural materials such as water lettuce, and rice straw is an approach available to farmers to replace the use of more expensive commercial media. The results from this work can be introduced to organic farmers as an alternative method to prepare growing media with the use of locally available organic amendments.

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