An Economic Analysis of Two Grafted Tomato Transplant Production Systems

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Summary

Grafting of herbaceous vegetables is an emerging development in the US and this report provides an estimate of the variable costs of grafting within two US tomato (*Solanum lycopersicum*) transplant production systems. Grafted and non-grafted plants were propagated at two commercial farming operations and detailed economic production sequences were generated for each site. Grafted and non-grafted transplant production costs were $0.59 and $0.13, and $1.25, and $0.51, at the two locations, respectively (Fig 1). Direct costs associated with grafting (e.g. labor, clips, chamber, etc) accounted for 37% to 38% of the added cost of grafting (Fig 2), and grafting labor was 11.1% to 14.4% of the cost of grafted transplant production. Seed costs represented 52% and 33% of the added cost of grafting at the two sites, and indirect costs (e.g. soil, trays, and heating) accounted for 10% and 30% of the added cost of grafting (Fig 2). Our findings suggest that under current seed prices and with similar production practices, the feasibility of grafting in the US is not disproportionately affected by domestic labor costs. Additionally, the economic models presented in this report identify the cost of production at various transplant stages, and provide a valuable tool for growers interested in grafted tomato transplant production and utilization.

Introduction and Research Objectives

Although interest in grafting is high among US growers and researchers, little work has been done to determine the economic costs and potential benefits of grafted transplant production for retail and commercial sale, or on-farm use. Furthermore, the first step in development of tomato production budgets with and without the use of grafting is to determine the cost of comparable grafted and non-grafted plants. Therefore, it is critical to identify the specific cost or range of costs that growers may experience as they produce grafted plants or implement grafting into their farming operations.

Published reports on the cost of grafted tomato transplants are rare. In Morocco, non- and grafted tomato plants were produced for $US 0.19 and $US 0.38, respectively (Besri, 2003). In a recent review article, the use of grafted plants was estimated to add $0.60-$0.90 per transplant (excluding seed costs) for US production (Kubota et al., 2008). Currently, ca. 40 million grafted transplants are imported into the US for large greenhouse operations (Kubota et al., 2008), and the estimated cost of the Canadian transplants is $2.00 per plant in addition to seed costs (C. Powell, personal comm). A preliminary report from NC suggested that the utilization of grafted plants would increase fruit production costs by $2,275 per acre (O'Connell et al., 2009).

In order to identify the relevance of grafting for domestic tomato production, it is essential to determine the cost of grafted transplants propagated in the US. Therefore, the goal of this study was: 1) to identify growers in the US who successfully produced grafted tomato transplants, report their production models and any corresponding variable costs associated with grafted and non-grafted propagation; 2) to dissect the variable costs of grafted production and examine grafting labor and other key components that could be important considerations for propagation in the US; and 3) to determine if tomato grafting can provide an economic benefit to local propagation facilities by adding value in tomato transplant production

Materials and Methods

Grafted and non-grafted tomato plants were produced at Black River Organic Farm (Ivanhoe, NC) and Good Harvest Farms (Strasburg, PA) independently. Rootstock and scion cultivars were chosen based on the needs of each farm/market, and grafting and healing chamber management was conducted by farm personnel. Three "batches" of grafted plants were produced throughout the spring at each site. Detailed transplant production sequences were formulated independently based on the experiences of each on-farm collaborator, and the variable costs associated with grafted and non-grafted transplant production were calculated. A detailed grafted and non-grafted production sequence was generated for each location based on the data and experiences gained at each facility. Line items included all variable costs associated with grafted and non-grafted transplant production, and were specific to each location. Summaries of the variable per plant production costs are shown in Figures 1 A-B with the accumulation of variable production costs plotted on the y-axis. The discrete and continuous costs of each production stage are illustrated in the figures by the height of the rectangles and the slopes of the corresponding triangles, respectively. The transplant production sequence was plotted along the x-axis to illustrate the costs of specific transplant stages. The distribution of the added costs of grafting is shown in Figure 2, and this approach describes the proportion of each factor (e.g. seed costs) in relation to the added cost of grafting ([(SEEDgraft – SEEDnon) / (TOTALgraft – TOTALnon)]).

Results and Discussion

The case studies presented here represent two contrasting models of transplant production. Our results show that prior to mark-up, the utilization of grafting for tomato production could add \$0.46 to \$0.74 per plant, and including a 50% mark-up, this additional cost could be \$1.12 per plant. Our findings are generally higher than those found in Morocco (Besri, 2003), but are consistent with the estimated additional costs provided in a recent review (Kubota et al., 2008). US growers and university personnel are concerned about the high cost of labor and its relevance on grafting. However, it is important to note that many of the commercial propagation facilities utilizing manual grafting worldwide are located in countries where labor prices are similar or only slightly less than in the US (eg Japan, Spain, and Italy (Besri, 2003, 2007; Kubota et al., 2008; Lee, 2003; Minuto and Causarano, 2008). In these case studies, we found that grafting labor costs made up a relatively small portion of the added cost of grafting, and labor costs were proportionally lower or similar among grafted plants as compared to non-grafted ones. These results indicate that labor prices in the US may not be as important as previous speculations have suggested.

An important consideration for growers wishing to implement grafting for tomato fruit production is whether plants will be purchased or grown on the farm. In the PA case study, per plant mark-up costs were ~150% higher using grafted plants than non-grafted ones, and this factor adds further costs for tomato fruit growers. The initial expense of grafted transplants may

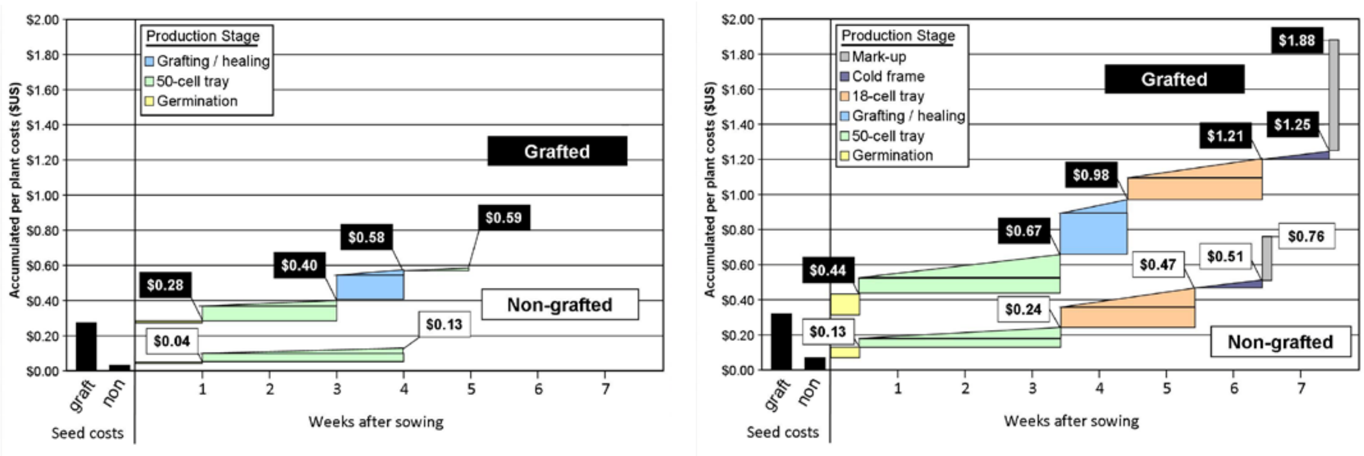

Figure 1 – Economic timeline of a grafted and non-grafted tomato transplant at (A) Black River Organic Farm (Ivanhoe, NC) and (B) Good Harvest Farms (Strasburg, PA).

reduce the likelihood of adoption in some growing systems and our results showed that the total per plant increase in transplant costs ranged from 64%-354%. Clearly, further work that ascertains any economic benefits of grafting in tomato fruit production will be of value to growers in the US. Worldwide, grafting has been utilized mainly in greenhouses and high tunnels (Kubota et al., 2008; Lee, 1994) and preliminary reports that tunnel growers in the US would benefit from grafted plants (Groff, 2009, O'Connell et al. 2009). The adoption of high tunnels in the US and the expansion of retail markets for grafted plants could be a valuable avenue for propagators looking to establish grafted transplant sales.

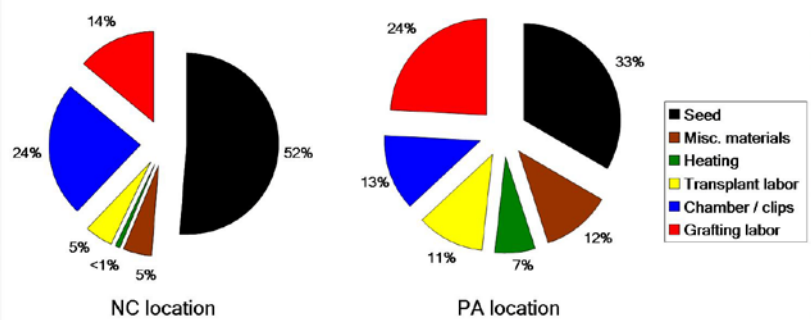

Figure 2 – Distribution of the added cost of grafting

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