PennState
College of Agricultural Sciences

PROPOSAL TRANSMITTAL

Date: 12/12/2018 **PSU Ref. No: 206127**

Title: Effects of Maintenance of Training Systems to a Hedgerow

Submitted to: Patti Keller

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Proposed Project **6/1/2019 - 5/31/2020** **Total Project Request: $9,100**

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Please reference PSU Ref. Number in all correspondence.

Research Grant Proposal
To
State Horticultural Association of Pennsylvania, Inc.

TITLE: Effects of Maintenance of Training Systems to a Hedgerow
PERSONNEL: Robert M. Crassweller, Daeun Choi, D. E. Smith
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DURATION OF PROJECT: 2018 – 2022

JUSTIFICATION: Future directions in orchard productivity strongly suggest that for large scale plantings some form of mechanization will be necessary. Work by Baugher (2006) with orchard platforms has shown that there is considerable savings to be realized with their use for pruning, thinning and potentially harvest. In 2016 we acquired a Bartlett electric platform that can be used in our system plantings at Rock Springs. For any platform system to be successful, the tree architecture must have a thin mantle depth. The maximum depth of any canopy will be approximately 2.5 to 3 feet. An Axe/Tall Spindle type system and trellis system would seem to fit these requirements. The Axe system keeps a very narrow conical shape in the upper portions of the tree. While the trellis maintains a vertical even depth canopy the entire height of the tree. In our trellis the maximum width of the canopy at the end of the growing season is approximately 4.5 feet (2.25 ft. per side) which would provide for higher light penetration and improved fruit quality and color.

Robinson et al. (2007a, 2007b) proposed the Tall Spindle as the next logical evolution in training systems. This system is an amalgamation of the Axe and Super Spindle. The main difference between it and a traditional axe is that there are no permanent scaffolds anywhere in the tree. New branches are generated by the continual removal of vigorous shoots and the bending of shoots below horizontal in the lowest portion of the canopy when trees are young. Additionally any upright vigorous branches are also removed. Recently, it has been proposed that the tall spindle be converted to a fruiting wall utilizing summer hedging (Lenhart, 2013).

Hedging is not a new concept and considerable effort was expended to evaluate this practice as a means of reducing production costs (Cain, 1971., Emerson & Hayden, 1984, and Ferree, 1992). The general conclusion from those and other studies was that hedging was not efficient, cost effective or conducive to increased production. However, at that time there was not the range of dwarfing rootstocks available that there is currently. Common rootstocks used then were M.7, M.9/MM.106 interstem or M.26. Trees on these rootstocks were much more vigorous. The training systems for orchards also produced trees with much wider and denser canopies. In these early studies the loss of the plant growth regulator Alar further reduced the potential of mechanical hedging. Fortunately the development of the plant growth regulator prohexadione calcium (Apogee or Kudos) has added a new tool in our arsenal that may make mechanical hedging feasible in today's production system. Robinson et al. (2013) have suggested that with our newer dwarfing rootstocks and the use of new training systems that hedging may be a viable method to reduce hand labor and increase labor efficiency.

OBJECTIVES: To evaluate the conversion of tall spindle (TS), vertical axe (A), minimally pruned (MP) to a hedgerow system and comparison to an existing tall trellis (TT) for two apple cultivars

PROCEDURE: Daybreak Fuji/M.9T337 and Rubinstar Jonagold/B.9 were planted at Rock Springs in the spring of 2008. The four systems consisted of four tree plots and six replications and were set in two rows for each cultivar. Trees were spaced at 5 x 14 feet or 622 trees per

acre. The systems utilized were a Tall Trellis (TT), Axe (A), Minimal Pruned (MP), and Tall Spindle (TS). We propose to convert these established trees to a vertical tree wall hedgerow that will be maintained through pruning by hedging. Originally, as described above, the design of the orchard was set up as 6 replications of 4 trees each in one of 4 training systems.

Yearly data to be collected will be tree size as measured by TCSA, yield, number of fruit/tree, fruit size and pruning time. Flowers will be counted in the first years of the planting and flower density will be calculated. Economic analysis will be developed to compare the differences between systems.

Additionally the hedger will be used by Dr. Dana Choi in her studies to measure and estimate fruit load and yields on the narrow canopies. We also anticipate sharing the hedger with Dr. Schupp for his future work in peaches.

BUDGET:

Salaries (Donald Smith) $6,117.00
Fringe Benefits $2,383.00

Fringe benefits are computed using the fixed rates of 38.97% applicable to Category I Salaries, 14.74% applicable to Category II Graduate Assistants, 7.81% applicable to Category III Salaries and Wages, 0.18% applicable to Category IV Student Wages, and 25.34% for Category V, Postdoctoral Scholars and Fellows, for fiscal year 2019 (July 1, 2018, through June 30, 2019). If this proposal is funded, the rates quoted above shall, at the time of funding, be subject to adjustment for any period subsequent to June 30, 2019, if superseding Government approved rates have been established. Fringe benefit rates are negotiated and approved by the Office of Naval Research, Penn State's cognizant federal agency.

Supplies $600.00
Total $9,100.00

REFERENCES:

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Robinson, T., A. DeMaree & S. Hoying. 2007a. An economic comparison of five high density apple planting systems. Acta Horticulturae 732:481-489.

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