



Texas A&M Floriculture and Nursery Research Initiative

Optimizing Inputs To Increase Profitability, Improve Integrated Pest Management and Retain Marketability

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Introduction

Floriculture sales are growing fastest in the Southern regions with Southern growers recently taking 42% of the U.S. market. The high value of floricultural crops and their increases in production areas results in increasing inputs of pesticides and fertilizer. An industry pre-requisite is to maintain profitability and sustainability with manipulation of inputs representing one side of the economic equation in achieving these goals. Often fertilization is geared toward maintaining crop health without consideration for the effects of increased fertility on population growth of arthropod pests. To assure ongoing economic health of this vital industry, with reduced inputs while maintaining effect total crop management, we examine: 1) if reduced fertilization can save growers money while maintaining crop marketability, 2) how do reductions in fertilization influence IPM approaches, and 3) a novel approach in transferring research to grower implementation.



Reduce Fertilizer – Save Money and Maintain Marketability

Research results demonstrate significant reductions of fertilization inputs can be achieved in hardy ornamentals with significant cost savings to growers. To date, we have been able to save potted rose growers in Texas \$10,000 - \$12,000 per crop (160-500,000 plants) by reducing fertilization inputs with no loss in crop qualities (see below). As more than half of the rose bushes in the U.S. are packaged and shipped from northeast Texas (Office of the Texas Comptroller), the benefits returned to the industry from this research will surpass the funding allocation to the project in less than 5 to 7 years. Halving the standard fertilization rate did not compromise growth of *Mandevilla splendens* 'Alice Dupont' during the first 10 weeks of crop growth prior to transplanting, thus saving the grower \$420 US for a crop of 35,000 potted *Mandevilla*. In gerbera, flower production and the number of days to pollen shed were similar for plants receiving 0.3X and 1X the recommended fertilization, both were rated as marketable. Herbaceous ornamentals such as potted chrysanthemums are much more sensitive to reductions in fertilization, and marketability decreases dramatically with relatively small changes in fertilizer input.



Benefits of Reduced Fertilizer to IPM Approaches

Tropicana roses fertilized with either 30% or 100% of the recommended rate produced similar numbers of harvestable flower stalks, but plants fertilized with the low rate had, on average, 30% fewer thrips than plants fertilized with the high rate. Lowering fertilization enhanced control of *Frankliniella occidentalis* with *Amblyseius swirskii*; plants with predatory mites and fertilized with the high rate had twice as many thrips as did plants with predatory mites and fertilized with the low rate. Combining *Orius insidiosus* and *A. swirskii* slightly improved control of *F. occidentalis*, but thrips control was most cost-effective with *A. swirskii* alone.

Research examining host plant resistance characteristics of gerbera (*Gerbera jamesonii* 'Festival Salmon') utilized three fertility levels (0X, 0.3X, or 1X 200 mg L⁻¹ N) of the recommended fertilization rate for gerbera. Phenolics are constitutive secondary metabolites that negatively affect insect feeding. Western flower thrips feeding did not affect phenolic content, but did induce the accumulation of the phytohormone, jasmonic acid—which is known to regulate inducible defenses against insect herbivory. Total phenolics increased as fertilization was reduced; however, flower production was similar for 0.3X and 1X fertilization regimes, thus suggesting that host plant resistance to western flower thrips could be manipulated by altering fertilization regimes.



Getting the Message Out

The average US floriculture grower employs more than 15 workers. The majority of field workers in the industry are of Hispanic origin, have little formal education, and lack simple yet essential technical knowledge required in plant health maintenance efforts. Pest problems often go unnoticed and untreated until they reach levels which trigger frequent and intensive pesticide applications that could be avoided by early pest detection and regular sanitation practices within IPM programs. Carlos Bográn leads a technical certification program in Spanish entitled 'Taller Manejo Integrado de Plagas', Spanish for integrated pest management-workshop, targeted at Hispanic workers in the greenhouse industry. The purpose of the five- module program is to provide workers with basic knowledge on IPM and the pest problems that impact ornamental crops. The sessions cover principles of pest and disease management, basic biology of insects, mites and pathogens, plant health maintenance, pesticide management and integration of control tactics. Armed with this knowledge, workers are in the position to 1) understand their role in the successful implementation of IPM strategies, 2) participate in sanitation, pest detection and monitoring practices, and 3) directly contribute to plant quality assurance efforts to increase profitability and reduce health and environmental risks. Grower satisfaction with the program is high. They frequently report an increase in worker satisfaction with their jobs and a better understanding of their role in pest management and crop quality assurance.

Advancing Science and the Industry Through ...

Publication of 12 peer- or editor-reviewed publications, 44 presentations at scientific and industry conferences, and publication of 26 grower- and industry-related materials since the Portland, OR 2006 meeting. Select scientific publications include:

Chow, A., A. Chau and K.M. Heinz. 2009. Compatibility of *Amblyseius (Typhlodromips) swirskii* (Acari: Phytoseiidae) and *Orius insidiosus* (Hemiptera: Anthorcoridae) for biological control of *Frankliniella occidentalis* (Thysanoptera: Thripidae) on roses. Submitted to *Biological Control*. July 2009. MS# BC09-09-253.

Chow, A., A. Chau, and K.M. Heinz. 2009. Reducing Fertilization for Cut Roses: Effect on Crop Productivity and Twospotted Spider Mite Abundance, Distribution, and Management. *Journal of Economic Entomology* 102 (5): 1896-1907.

S.E. Beach, T.W. Starman, K.L. Eixmann, H. B. Pemberton, and K.M. Heinz. 2009. Reduced End-of-production Fertilization Rate Increased Postproduction Shelf Life of Containerized Vegetative Annuals. *HortTechnology* 19: 158 - 167.

Liu, T.-X., L. Kang, K.M. Heinz, and J.T. Trumble. 2009. Biological control of *Liriomyza* leafminers: progress and perspective. *CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources* 2009 (4), No. 004. 1-16.

Chow, A., A. Chau, and K.M. Heinz. 2008. Compatibility of *Orius insidiosus* (Hemiptera: Anthorcoridae) with *Amblyseius (Phiseius) degenerans* (Acari: Phytoseiidae) for control of *Frankliniella occidentalis* (Thysanoptera: Thripidae) on greenhouse roses. *Biological Control* 44 (2) : 259-270.

Spiers, J., F. Davies, C.J. He, S. Finlayson, K. Heinz, A. Chau, and T. Starman. 2007. Fertilization affects western flower thrips abundance, total phenolics, and growth characteristics in *Gerbera jamesonii*. *HortScience* 42 (4): 902-902.

Bader, A.E., K.M. Heinz, R.A. Wharton and C.E. Bográn. 2006. Assessment of interspecific interaction among parasitoids on the outcome of inoculative biological control of leafminers attacking chrysanthemum. *Biological Control* 39 (3): 441-452.

Bográn, C.E. & K.M. Heinz. 2006. Time delay and initial population density affects interactions between *Encarsia pergandiella* Howard and *Eretmocerus mundus* Mercet (Hymenoptera: Aphelinidae). *Environmental Entomology* 36: 661-669.

Chau A. & K.M. Heinz. 2006. Manipulating fertilization: a management tactic against *Frankliniella occidentalis* on potted chrysanthemum. *Entomologia Experimentalis et Applicata* 120: 201-209.

Spiers, J. D., F.T. Davies Jr., C. He, C.E. Bográn, K.M. Heinz, T. Starman, and A. Chau. 2006. Effects of insecticides on gas exchange, vegetative and floral development, and overall quality of gerbera. *HortScience* 41(3): 701-706.

Arthurs, S. and K.M. Heinz. 2006. Evaluation of the nematodes *Steinernema feltiae* and *Thripinema nicklewoodi* as biological control agents of western flower thrips *Frankliniella occidentalis* infesting chrysanthemum. *Biocontrol Science and Technology*. 16(2): 141-155

Chow, A. and K.M. Heinz. 2006. Control of *Liriomyza langaei* on chrysanthemum by *Diglyphus isaea* produced with a standard or modified parasitoid rearing technique *Journal of Applied Entomology* 130 (2): 113-121.

Training the next generation of scientists (3 postdoctoral scientists, 2 graduate and 10 undergraduate students) who hold positions benefiting the industry.

Effective leveraging of FNRI funding. On average, each member of the team received \$17,650 per year that was effectively leveraged at a level greater than 1:5 from other external sources.

Future Approaches

Profitability and sustainability remain key elements to perseverance of the industry during these economically challenging difficult times as well as when competition among growers is keen. If funding is continued, we will utilize national survey data to populate economic models that will identify, manipulate, test, and evaluate additional input vectors that will yield scientifically robust solutions immediately implementable by growers to insure their profitability and sustainability.

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