

Economics and Marketing

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The Healing Power of Plants

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Significance to Industry There is a small but growing body of scientific evidence suggesting that interactions with plants impact human mental and physical health. As empirical evidence supporting the linkages between people-plant interactions and human health increases, there is a rising realization that plants may prove to be a powerful countermeasure to the stress and mental health deterioration associated with life in a rapidly urbanizing world (1). Once the public understands the range and potency of therapeutic benefits achievable through people-plant interactions, demand for all kinds of plants will inevitably grow to satisfy an enhanced consumer desire for healthy urban living. Therefore, horticulture as a therapeutic modality, could reach a similar level of traction among consumers that has been achieved by the organic food industry. This would represent a potentially expanding market for industry products related to the greening of both interior and exterior urban environments.

Nature of Work This paper will briefly delve into some of the evidence for the therapeutic benefits of plants obtained through people-plant interaction.

Results and Discussion People-plant interactions date to our earliest beginnings, and therefore the argument can be made that we have a connection with plants that is unique and special. We have relied on plants for so long and in so many ways for our very survival. It could be suggested that we have been genetically programmed through positive selection to need plants in our daily lives for mental health reasons just as we do for the dietary and nutritional health benefits that they provide (2). If true, then plants are important for the health of the body and the mind. If so, this mental health aspect of people-plant interactions remains largely unexplored by biomedical sciences.

Gardening has been practiced by humans well before the beginning of the Neolithic Age, about 12,000 years ago, providing food and nutrition that has helped sustain us. Neolithic gardening improved our chances for survival and served to link us to nature and the natural plant world. In contrast, the concept of horticulture as mental health therapy dates only to the early 19th century when Dr. Benjamin Rush first recognized the therapeutic benefits of gardening for individuals suffering from mental health disorders (3). By the end of World War I, horticultural therapy (HT) had become more widely practiced, particularly because returning war veterans in VA rehabilitative hospitals were given HT to hasten

their convalescence and recovery. The therapy was provided by Garden Club members that offered courses on horticulture including garden establishment, plant identification, and greenhouse construction (4).

Horticultural therapy is a specialized adaptation of the gardening that people have been doing for millennia, for it encompasses a purposeful clinical and therapeutic dimension. Horticultural therapy is now widely practiced in developed countries throughout the world (5). While there is a broad anecdotal perception and acceptance that gardening and HT provide *real* health benefits beyond that of fulfilling nutritional requirements (6), considerable new research is acutely needed to better quantitatively define the actual mental health benefits these two horticultural activities provide. Beyond elevating the potential medical value of HT, further research may suggest that individual gardening and caring for plants has the potential to become a recognized form of mindfulness therapy for stress reduction and psychological well-being (7) that does not require pharmacological intervention to achieve improved health and well-being outcomes.

A review of the published scientific literature on therapeutic benefits of gardening and HT has revealed a surprising paucity of high quality experimental research. While the volume of research literature on gardening and HT is large, most studies for many different reasons have been found to be scientifically weak or significantly deficient (8, 9, 10).

Yet, imagine for a moment what it would mean to the green industry, if it were to become common knowledge that gardening on a regular basis could contribute to the prevention or delay the onset of dementia by as much as 36%, reduce perceived psychological stress indication by 38%, or lead to a 25% reduction in mortality over a 15 year period for people going through their 50s, 60s and 70s. It turns out these are authentic results taken from three different studies (11, 12, 13).

However, without a better clinical understanding of the efficacy and treatment effects, it will not be possible for people-plant interactions like gardening or HT to make a major transition to a medically recognized, mainstream health and wellness modality. Horticultural therapy is not presently a medically recognized therapeutic intervention covered by health insurance in the United States. Thus, there exists an urgent need for a coherent foundation of solid clinical research demonstrating cause and effect of people-plant interactions. A body of reliable quantitative measures of benefit per treatment regime, with dosage considerations, is needed before HT can become a medically accepted treatment modality and a standard adjunct to current clinical treatment practices. Similarly, for gardening to become a professionally recommended therapeutic behavioral modality implemented to maintain or improve mental health and overall well-being, we must support anecdotes with robust experimental evidence.

As the name implies, horticultural therapy resides at the intersection of horticulture, plant sciences, medical sciences, psychiatry, psychology, sociology, social sciences, occupational therapy, clinical practice and health and human sciences. A survey of the published literature commonly finds studies conducted by horticulturists, horticultural

therapists, health care analysts, psychologists, psychiatrists, nurses or other clinicians. Given the interdisciplinary nature of HT, the experimental designs of many studies seeking to define HT benefits have focused on one aspect or another, but most studies have often lacked a proper holistic and well-controlled experimental design. At the University of Florida, a Land-grant university with an institute of agriculture and a medical school, a study on the therapeutic benefits of HT and gardening has brought together an interdisciplinary team consisting of a registered horticultural therapist (HTR), a professor of Horticultural Sciences, a physician and professor emeritus of the College of Medicine, and faculty from Psychiatry, Psychology, Neurosciences and Health Policy Research to contribute to a multidisciplinary experimental design and outcome analysis. The ongoing study is an opportunity to clearly demonstrate the restorative and therapeutic benefits of plants, gardening and HT. Therefore, this study begins to establish what millions of gardeners already know and feel, but are unable to experimentally prove. The objective of the research is to test the hypothesis that participating in group-based gardening activities has measurable therapeutic benefits on the mental health status of gardening-naïve, healthy women. It is a novel idea to suggest that the health status of healthy women could be improved by engaging in gardening or HT activities. Yet, the magnitude of anecdotal support for such a concept coming from millions of gardeners is so overwhelming, it seems impossible not to be true. Our work on this represents a first-of-its-kind study given the demographic of the study participant population. In 2015, our research consortium of investigators conducted a highly-controlled pilot experiment with a population of 23 healthy, premenopausal women ages 26-48. The results from that experiment quantitatively support the hypothesis and appear to be very promising. Briefly, the scores from five different psychometric assessments administered at the beginning and following the completion of the gardening treatment suggest statistically significant improvements in the mental health profiles of the healthy women for depression symptomatology, perceived stress, anxiety and mood state disturbances. In contrast, virtually no improvements for any of these psychometric assessments were observed for the control group that received no treatment intervention.

In summary, the green industry can benefit from top-quality scientific research that quantitatively demonstrates the therapeutic benefits of plants, gardening, HT and other similar forms of people-plant interactions. Such research findings will inform marketing campaigns in innovative ways, and attract interest from all forms of popular media to publicize and promote documented health benefits which would be especially pertinent to a rapidly growing urban population that is increasingly health-conscious.

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Can the Trans-Pacific Partnership Benefit U.S. Nursery and Floriculture Producers?

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Index Words Nursery and floriculture products, exports

Significance to Industry Tennessee generated sales of \$295 million from nursery, greenhouse, floriculture and sod on 1,149 farms, according to the 2012 Census of Agriculture. This sector ranked 4th in terms of total value of sales, making up about 8.2 percent of the value of total sales (USDA, 2012). In the U.S., these crops were grown on 52,751 farms with a total of about \$15 billion in sales. In 2013, the U.S. exports totaled \$2.3 trillion, a 27 percent increase (adjusting) for inflation from the 2009 figure (U.S. Department of Commerce, 2014). The Trans-Pacific Partnership (TPP) agreement promises to further expand trade even further. The U. S. nursery and floriculture products industry will benefit from export trade expansion.

Signed on February 4, 2016, in Auckland, New Zealand, the TPP is a trade agreement involving 12 countries. The agreement was reached after seven years of negotiations (Oustr). The TPP countries include: Australia, Brunei, Chile, Indonesia, Japan, Mexico, New Zealand, Peru, Singapore, South Korea, the United States and Vietnam. Estimates by Bala Ramasamy (2016) showed that TPP members will witness significant increases to their trade. Because of this partnership, US annual real income is expected to increase by 0.5 percent of GDP while annual exports will increase by 9.1 percent. Exports from Japan, Vietnam and Malaysia are expected to increase by 23.2 percent, 30.1, and 20.1 percent, respectively. The U.S. led with up to 50 percent of the TPP countries in exports. If this trend continues, U. S. exports will increase and support high-paying domestic jobs. In 2013, U.S. exports to TPP countries totaled \$698 billion, representing 44 percent of total U.S. exports. Agricultural products totaled \$63 billion, 42 percent of total U.S. agricultural exports. Small and medium-sized businesses in the U. S. alone exported \$247 billion to the Asia-Pacific in 2011. The Peterson Institute for International Economics estimated that TPP will add \$225 billion to the global GDP by 2025. Approximately, \$8.5 billion of the \$77 billion of the expanded growth in U.S. GDP will go to agriculture (Sheldon, 2015). The objective of this research is to use available data from U.S. International Trade Statistics to assess the possibility that U.S. exports of nursery and floriculture products to TPP countries will expand if the agreement receives final approval.

Nature of Work The export data analysis provided in this paper focuses on the industry code described in the 2012 North American Industry Classification System (NAICS) using data from sector 11 -- Agriculture, Forestry, Fishing and Hunting with more disaggregated data from the U.S. International Trade Statistics from the sub-sectors 111421, Nursery and Tree production and 111422 Floriculture production. This industry engages in growing

nursery and floriculture products (e.g., nursery stock, shrubbery, cut flowers, flower seeds, foliage plants) under cover or in open fields and/or (2) growing short rotation woody trees with a growing and harvesting cycle of 10 years or less for pulp or tree stock (e.g., cut Christmas trees, cottonwoods).

Results and Discussion As shown in Table 1, total U.S. exports of nursery products and trees increased from \$334.5 million in 2008 to approximately \$344.7 million in 2014 after a slight decline to \$342.6 million in 2013. An examination of the exports to ten TPP countries showed that, in 2015, exports to Mexico topped \$65.1 million followed by exports to Peru of \$7.6 million and Japan of about \$3.3 million. Percentage growth in exports was calculated as: U.S. trade in nursery products and trees to Vietnam increased 63.2% from a low of \$5,000 to a high of \$408,000 between 2008 and 2013 (Table 1). Average exports for 10 of the TPP countries for data collected from 2008 to 2015, showed a positive growth in export values (Figure 1). Overall, U.S. trade with ten countries in the Trans-Pacific Partnership rose by more than 77percent between 2008 and 2015. During the same period, there were only very slight declines in export trade with Australia (-0.1percent), Chile (-0.4percent), Japan (-0.5percent), New Zealand (-0.1percent) and Singapore (-0.3percent). U.S. nursery export trade with South Korea and Peru increased 1.4percent and 10.8percent, respectively. The percentages given above were calculated using equation (1):

$$\% \text{ change in exports} = \left(\frac{2015 \text{ exports} - 2008 \text{ exports}}{2008 \text{ exports}} \right) * 100\% \dots\dots\dots(1)$$

Next, this paper examines U.S. floriculture products export trade with the ten TPP countries where data were available. The U.S. recorded positive gains in export trade for all except two (Indonesia and Singapore) of the ten TPP countries shown in Table 2. Significant trade gains were recorded for Australia, Chile, South Korea, Mexico, Peru, and Vietnam with increases of over 200 percent recorded for Peru and more than 400 percent for Vietnam. Average U. S. exports of floriculture products showed a positive trend between 2008 and 2015 (Figure 2). Average floriculture products exports from 2008 to 2015 for the 10 TPP countries were calculated using equation (2):

$$AFE = [\sum E_i]/n \dots\dots\dots(2)$$

Where: AFE = average floriculture exports, n = 10 countries and, E_i = exports for i^{th} country. This brief data on specific U.S. exports to ten countries in the Trans-Pacific Partnership suggests that, if the observed pattern in nursery, tree, and floriculture products continues, U.S. exports will benefit from expanded trade that will follow the ratification of the agreement. While it is difficult to predict which individual producers may benefit or how much the gain may be from such expanded trade, it is possible to assume that will be increased exports of these products. Trade expansion and gains will come from reduced tariffs and trade barriers, artificial and otherwise among the countries involved in this partnership.

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Table 1. Average gain or loss in U.S. exports of nursery products and trees* to ten Trans-Pacific Partnership (TPP) countries.

Gain / Loss (%)	Exports: F.A.S. Value Basis (in thousands of dollars)**								
	2015	2014	2013	2012	2011	2010	2009	2008	
World	2.0	341,167	344,700	342,634	294,813	344,415	315,930	297,799	334,508
Australia	-0.1	949	808	1,313	1,025	580	679	574	1,019
Chile	-0.4	133	378	630	362	333	126	86	233
Indonesia	2.6	182	77	711	955	1,322	2,103	74	51
Japan	-0.5	3,311	2,530	2,809	2,545	3,881	4,813	4,835	6,450
Korea, South	1.4	1,901	2,103	2,455	1,452	1,279	1,261	1,585	787
Mexico	0.8	65,133	60,100	58,471	50,785	44,536	28,094	27,441	37,002
New Zealand	-0.1	367	565	185	299	409	442	375	388
Peru	10.8	7,600	6,337	1,972	1,608	528	522	722	646
Singapore	-0.3	709	1,028	533	549	1,818	546	1,002	1,010
Vietnam	63.2	321	167	408	544	102	41	27	5
Average	8.1	7.7	8.1	7.0	6.0	5.5	3.8	3.7	4.8

*Value of Exports by (NAICS - 111421) Nursery Products & Trees in thousands of dollars (\$'000)

**F.A.S. Export Value (Excluding Exports to Canada). The F.A.S. (free alongside ship) value is the value of exports at the U.S. seaport, airport, or border port of export, based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier at the U.S. port of exportation. The value, as defined, excludes the cost of loading the merchandise aboard the exporting carrier and also excludes freight, insurance, and any charges or transportation costs beyond the port of exportation. Source: Guide to Foreign Trade Statistics. http://www.census.gov/foreign-trade/guide/sec2.html#fas_value

Table 2. U.S. Exports of floriculture products to ten TPP countries, 2008 - 2015.

Country	2008	2009	2010	2011	2012	2013	2014	2015	Percent
World	141,860	142,877	151,096	139,421	106,405	103,487	96,238	94,583	-33.3
Australia	1935	2389	2075	2144	2474	2645	2,242	2,105	8.8
Chile	272	330	526	443	406	468	463	474	74.3
Indonesia	3	3	-	-	-	-	-	-	-100.0
Japan	4153	7173	6073	6404	5981	6792	5729	5506	32.6
South Korea	1803	2182	2,504	2,154	2,316	1,910	1,893	2,443	35.5
Mexico	606	674	727	970	815	852	1152	1016	67.7
New Zealand	623	527	845	810	803	956	901	993	59.4
Peru	123	309	283	326	400	412	441	458	272.4
Singapore	104	-	14	106	-	39	101	71	-31.7
Vietnam	85	77	40	70	82	188	240	468	450.6
Average*	0.97	1.52	1.45	1.49	1.66	1.58	1.46	1.50	

*Average in Millions of dollars (mil.\$)

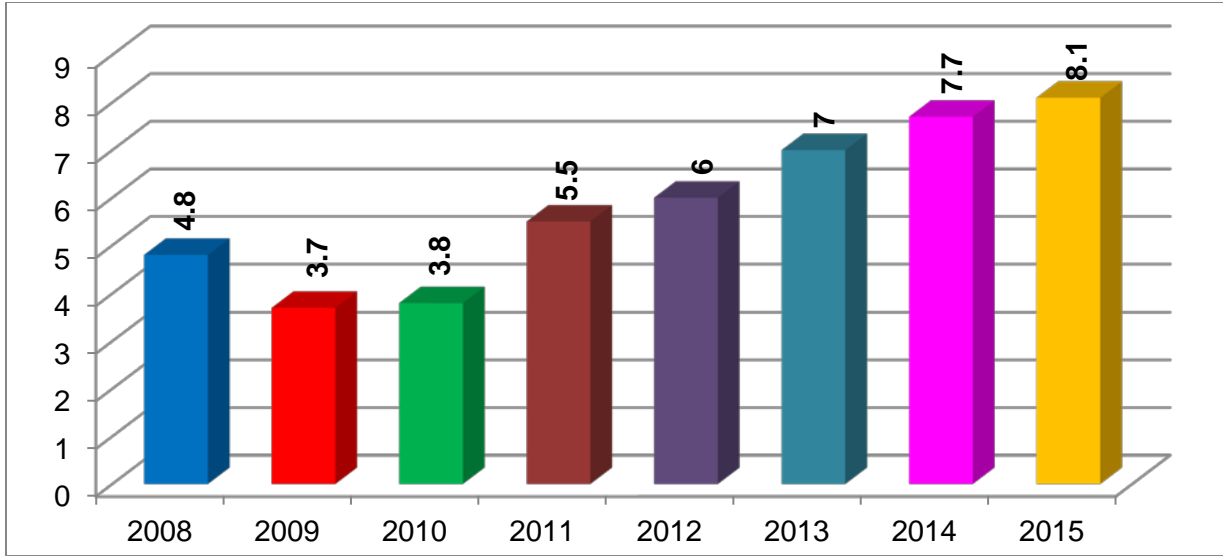


Figure 1. Average U. S. Exports of Nursery and Tree Products to ten TPP Countries (in millions of dollars).

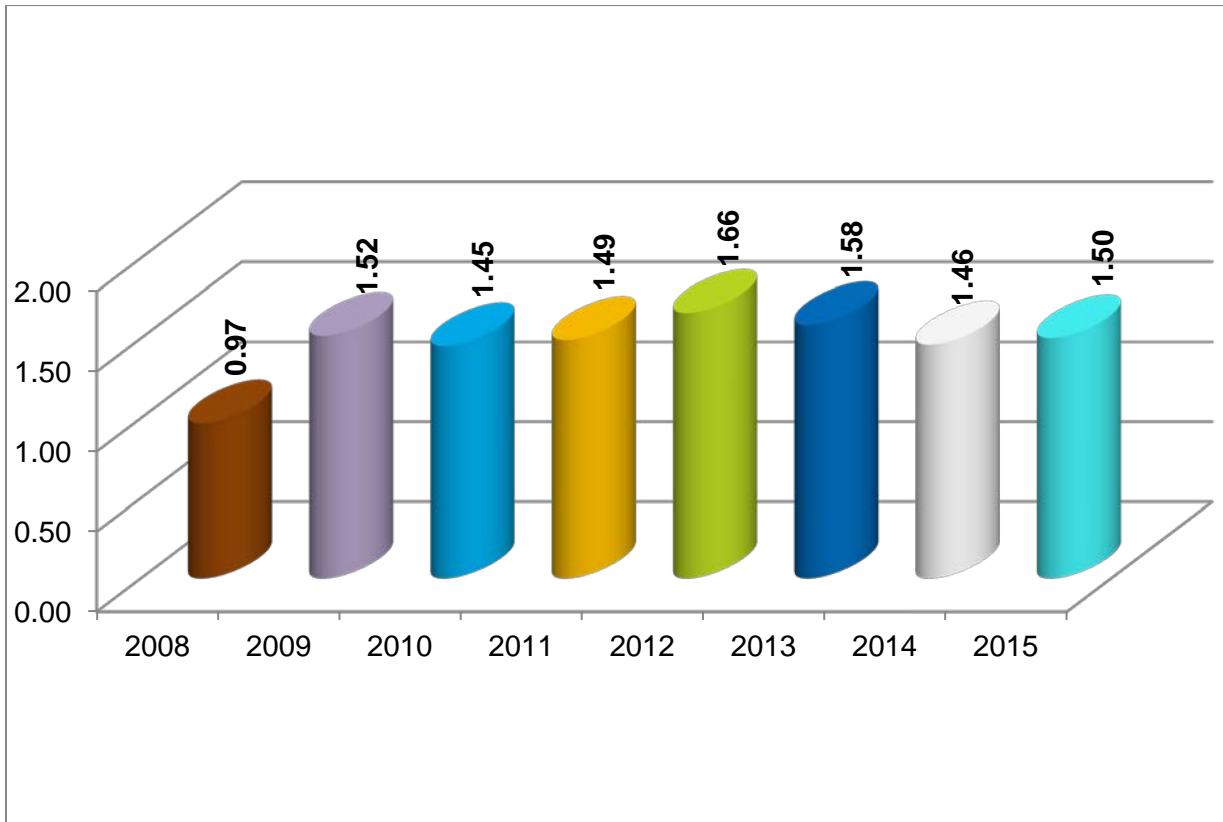


Figure 2. Average U. S. exports of floriculture products to ten TPP countries in millions of dollars.