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Investigating Factors that Affecting Citrus Waste Production in Mazandaran Province, Iran

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Abstract

Agricultural waste management is one of the important issues that agricultural producers should consider to increase their income and environmental protection. Therefore, the investigation of factors that reduce the rate of agricultural production wastage as well as citrus production wastage is of utmost consequence in order to manage wastes, reduce environmental degradation and ecosystem destruction, and increase food security and economic growth. Inspired by this assumption, the aim of this study was to investigate factors affecting citrus waste production in Mazandaran Province, Northern Iran (N= 7867). A stratified random sampling method was employed to collect data from 165 farmers. The main tool to collect data was a self-designed questionnaire whose content validity was approved by a panel of experts and an exploratory factor analysis (EFA), and its reliability was confirmed by calculating a Cronbach's alpha coefficient ($\alpha \geq 0.7$).The results of the exploratory factor analysis showed that socioeconomic and technical factors altogether accounted for 60.257% of variances in citrus production wastage.

Keywords:
citrus waste, factor analysis, socioeconomic factor, waste management

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INTRODUCTION

Traditionally, agriculture has formed the mainstay of rural economic activities, but it has been changed in the second half of the twentieth century in the direction of a much more balanced and diverse economy as more and more labor was driven out of the agricultural sector into employment in alternative sectors (Smit et al., 2015). Also, there is an extensive literature on agricultural productivity and economic growth in the field of spatial economics (Abreu et al., 2005; Bartelsman and Wolf, 2014; Gardiner et al., 2004; Van Oort et al., 2012). However, rising demand for food, increasing resource scarcity, high market volatility and growing environmental pressures challenge the agricultural sector not only to increase productivity but also to do so in a more sustainable manner (Godfray et al., 2010; OECD/FAO, 2012; Tilman et al., 2011). To address these challenges, agricultural producers must deal with multiple issues and often conflicting objectives.

Agricultural waste management is one of the important issues that agricultural producer should consider in their attempts to increase their income and environmental protection. Waste is an inevitable byproduct that arises from various anthropogenic activities and is also considered as one of the major sources of environmental degradation since it causes air, land and water pollution and contributes to global warming (Pagiola, 1995). Therefore, the investigation of factors that reduce the rate of agricultural production wastage as well as citrus production wastage are vitally important in order to manage waste, reduce environmental degradation and ecosystem destruction, and increase food security and economic growth. In this regard, this study attempts to investigate factors affecting citrus production wastage in Mazandaran Province.

Iran, like most developing countries, faces an increase in the generation of waste in agricultural sectors (Ministry of Agriculture, 2007). In this regard, the waste generated in agricultural sector is mostly associated with gardening production. According to the Iranian annualreports about gardening production, yearly 170,000 tons of citrus production in Mazandaran Province is wasted. Researchers argue that waste generated in Mazandaran Province occurred after the harvesting. Also, they reported that factors such as gardens' watering management, timely access to the marketplace, the gardeners' knowledge about marketing and government subsidy (Kasozi and Mwegombi, 2008), citrus sorting based on size, and gardeners' experience and their academic degree (Andrea et al., 2003) can reduce the rate of citrus wastage.

According to the literature (Andrea et al., 2003; Zheng et al., 2010; Srivastava & Singh, 2009; Kasozi & Mwegombi, 2008) we can categorize factors affecting citrus waste production in three broad dimensions: (A) socioeconomic factors (e.g. lack of government subsidy, lack of pricing policy, lack of farmers' knowledge about the citrus marketing and export, etc.); (B) infrastructure factors (e.g. of packing, lack of transporting, lack of storehouse, etc.); and (C) technical factors (e.g. of watering manage).

MATERIALS AND METHODS

The present survey is a quantitative study in nature, an applied study in terms of objectives, and a descriptive-correlation study in term of statistics. Statistical population consisted of all citrus growers in Mazandaran Province. A stratified random sampling method was employed to select 162 orchard farmers by applying Cochran's formula (see equation 1). The main tool to collect data was a self-designed questionnaire whose content validity was approved by a panel of experts and its reliability was confirmed by calculating a Cronbach's alpha coefficient (0.88-0.97). Data were analyzed by SPSS (v20) in two parts. In first part, descriptive statistics such as mean and standard division were used to ranking factors that affecting on citrus waste production; and in second, the explanatory factor analysis were used to identify factors that affecting on citrus waste production in Mazandaran Province.

$$n^2 = \frac{(t.s)^2}{d^2} \Rightarrow d = \frac{t.s}{\sqrt[2]{n}} \Rightarrow \frac{1.96 \times 2.69}{\sqrt[2]{30}} = 0.96 \div 2 = 0.48$$

$$n = \frac{N(t.s)^2}{Nd^2 + (t.s)^2} \Rightarrow \frac{7867 \times (1.96 \times 2.69)^2}{7867 \times 0.48^2 + (1.96 \times 2.69)^2} = 120 \quad (1)$$

% confidence (t) = 1.96
s = Variances
n = sample size
N = Population size

RESULTS AND DISCUSSION

Based on descriptive results, most respondents (n= 126) were male, and the most common age was something in between 51-60 years. More than 93% of landowners were married, and most of them (n=43) had a diploma.

Ranking of citrus waste production items (Table 1) showed that prolonged picking time, the lack of weed management, and inappropriate use of fertilizers had the highest influence on citrus waste production. The lack of skills to transplant trees among gardener, failure to comply with spacing, and selection of an unsuitable location for the orchard have the least effect on citrus waste production.

An exploratory factor analysis was used to determine factors affecting citrus waste production. Statistical analyses showed that the internal consistency of data was appropriate for factor analysis (KMO=0.938) and the Bartlett's test was significant (Bartlett=5937.196; $p<0.01$). Two factors were extracted by using the Kaiser's rule. Factor loadings after Varimax rotation are shown in Table 3. Next, according to the nature of variables, factors were named as socioeconomic and technical factors. Given the amount of extract eigenvalues, technical factor had the

Table 1
Ranking of factors that affecting citrus waste production

Items	Mean	S.D.	Rank
Prolonged picking time	4.44	0.65	1
The lack of weed management	4.36	0.74	2
Inappropriate use of fertilizers	4.28	0.72	3
Failure to do soil tests	4.26	0.76	4
Use of inappropriate pesticides	4.21	0.81	5
The high maintenance cost in refrigerators	4.17	0.84	6
Improper stockrooms	4.13	0.85	7
The use of contaminated gardening equipment	4.12	0.90	8
Lack of attention to garden management	4.11	0.89	9
Emission stain from calamity berry fruits	4.05	0.90	10
Citrus mechanical damages during harvest	4.05	0.95	11
Lack of attention to suitable picking time	4.05	0.93	12
Unsanitary of boxes	4.04	0.93	13
Inappropriate transportation	4.01	0.95	14
Pests	3.97	0.93	15
Inappropriate garden irrigation	3.96	0.94	16
No sorting of fruits	3.95	1.00	17
Lack of refrigeration	3.95	0.98	18
Lack of using preservatives	3.94	1.02	19
Lack of market for citrus	3.93	1.00	20
Improper packing	3.92	0.98	21
Loss of alternate industries	3.91	1.02	22
Unstable weather conditions (continuous rains or long dry)	3.90	1.01	23
Selection of an unsuitable location for the orchard	3.85	1.05	24
Failure to comply with the spacing	3.81	1.04	25
Lack of skills to transplant trees among gardener	3.79	1.08	26

Scale: very little = 1; little = 2; medium =3; high= 4; very high= 5

Table 2
Rotation sums of variables affecting citrus waste production

Factor	Eigenvalues	% of variances	Cumulative variance
1	14.692	36.729	36.729
2	9.411	23.528	60.257

Table 3
Factors and variables related to citrus waste production after the Varimax Rotation

Factor name	Variables	Load factors
Socio-economic	Prolonged the picking time	0.889
	The high maintenance cost in refrigerators	0.866
	Improper stockrooms	0.846
	Lack of attention to garden management	0.789
	Lack of attention to suitable picking time	0.787
	Lack of using preservatives	0.775
	Lack of market for citrus	0.770
	Loss of alternate industries	0.761
	The lack of weed managements	0.739
Technical	Inappropriate use of fertilizers	0.788
	Failure to do soil tests	0.774
	Use of inappropriate pesticides	0.760
	The use of contaminated gardening equipment	0.754
	Unsanitary of boxes	0.749
	Inappropriate transportation	0.747
	Inappropriate garden irrigation	0.745
	Lack of skills to transplant trees among gardener	0.735

highest effect on total variance of citrus waste production (Table 2). In total, 60.257% of citrus waste production variances were captured by these factors.

Agricultural waste management is one of the important issues that agricultural producer should consider in their attempts to increase their income and environmental protection. Therefore, the investigation of factors that reduce the rate of agricultural production wastage as well as citrus production wastage are vitally important form an aging wastage, reducing environmental degradation, ecosystem destruction, and increasing food security and economic growth. In this regard, this study attempted to investigate factors affecting citrus production wastage in Mazandaran Province.

Results of exploratory factor analysis showed that the socioeconomic and technical factors had the highest effect on the total variance of citrus waste production, and 60.257% of citrus waste production variances were accounted for by these factors. This finding confirmed the results of Andrea et al. (2003); Zheng et al. (2010); Srivastava and Singh (2009) and Kasozi and Mwegombi (2007). They argued that socioeconomic and technical factors affected citrus waste production. Based on this finding, the researcher suggested that government should (a) facilitate exportation of citrus; (b) establish the alternate industries in this region (c) educate gardeners about their needs such as weed management, appropriate use of fertilizers for citrus, appropriate garden irrigation, and so on; (d) establish stockrooms with high quality for citrus in this region; and (e) construct roads to facilitate citrus transportation.

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