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PRINT: ISSN 0970-9274 ONLINE: ISSN 2456-6608
J Hum Ecol, 72(1-3): 199-210 (2020)
DOI: 10.31901/24566608.2020/72.1-3.3286

Small-scale Citrus Farming among Selected Countries: Determinants for Exports and Production

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KEYWORDS Cultivated Area. Exports. Farm Size. Population Size. Production

ABSTRACT The objective of the analyses in the paper is to determine a combination of factors that enhances production and export capacity among selected countries practising small-scale citrus farming. Data was sourced through internet search using the search engine of EBSCO discovery and Scopus. Data was analysed using the multiclass discriminant analysis and frequency tables. The results shows that among the 10 sampled countries, the following population size, the rate of citrus consumption in local markets, availability of arable land, processing capacity, proximity to European markets and the counter-seasonal effect with Europe are important factors. For South Africa, important factors are big farm sizes and high crop yield. The income derived from small farms such as those of China and India, is not enough to lift farmers out of poverty. It is recommended for governments to determine a viable size of a citrus farm, which will improve farmer's living conditions.

INTRODUCTION

The citrus industry is of strategic significance to the economy of South Africa, and this is in terms of job creation and export earnings. During the 2015-2016 production season, it contributed R14.8 billion to the total gross value of agricultural production (DAFF 2017). Although South Africa, ranks number 13 in world markets in terms of citrus production (USDA 2012), since 2004, it assumed the position of being the second-largest exporter of citrus after Spain (NAMC 2018).

Despite high levels of competitiveness, when it comes to factors of production, the South African citrus industry is constrained and has low rainfall. There is scarcity of suitable land and irrigation water (WWF-South Africa 2017). In the face of a myriad of challenges faced by the industry, the commercial citrus sector has devised several strategies for competitiveness. For this study, essential strategies included consolidation of market power through the integration of several farms into single large operations (Freguin-gresh and Anseeuw 2014). This strategy, however, had transformed the entire citrus value-chain, into one that is highly capitalistic in favour of large-scale farmers while in the process, unintentionally marginalising small-scale citrus producers (Freguin-gresh and Anseeuw 2014). In other parts of the world, citrus enterprises are run by small-scale farmers, operating plots that are less than 10 hectares and as is the case in China and India even as small as 2 hectares. There is dearth of literature for studies comparing the performance of small-scale citrus farmers across countries. Some popular articles published in the South African Fruit Journal, such as those of Edmonds (2018a) and Edmonds (2018b) compared South Africa with some of the countries involved with small-scale citrus farming, but the focus was only on competitiveness with regard to market accessibility.

Problem Statement

In South Africa, citrus farms are enormous, relative to its trading rivals. In 2017, the average size of a citrus farm in South Africa was 72 ha in extent (CGA 2017; Genis 2018), and there are in-

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cidences where farm-sizes exceed 1000 ha and in extreme cases up to 6000 ha for a single enterprise (Urquhart 1999; Freguin-gresh and Anseeuw 2014). The 1996 transformation efforts for the citrus industry created a highly capitalistic agri-business structure that, in the process, marginalised small-scale farmers (Freguin-gresh and Anseeuw 2014). It is highly concentrated with essential marketing facilities controlled by few entities and the procurement of essential business services centralised (Cloete 2010). Through the CGA, there is proper coordination for private R and D and extension services (Partida 2011) to which farmers operating large farms can benefit. Some 2200 small-scale farmers cultivate a limited number of citrus trees and are left in the periphery (Philp 2006). These farmers do not enjoy the services rendered by farmer-organisations, such as the Citrus Grower Association of Southern Africa (CGA) (Freguin-gresh and Anseeuw 2014). The technical support they receive from public extension officers is weak and inefficient (DAFF 2016).

However, since 2014, there have been efforts from CGA, through its Grower Development Company, to extend services to small-scale citrus farmers and land reform beneficiaries (CGA 2016a). A significant number of land reform beneficiaries own large farms and are therefore regarded as emerging farmers and not small-scale farmers, yet they are constrained when it comes to accessibility of production resources. Most of these projects are community-owned, and they involve multiple beneficiaries, a situation that often resulted in conflicts.

Several cooperative citrus projects, accessed through the Land Reform program since 1998, even in recent times, such as in 2019, still rely on the government for financial support. The problems associated with community-owned projects are known globally. In China, for instance, during the period 1960 to 1970, communities jointly owned farms, but this approach resulted in significant failure rates (Ji et al. 2016). Even when big farms were to be sub-divided and shared among individual households in South Africa, there is no insight to inform such a policy reform. As of 2017, among the 123 black emerging citrus farmers registered in CGA, on average, each owned a farm that was 72 ha in extent (CGA 2017). In 2016, these farmers grew citrus on seven percent of the entire orchards (68,272 ha), yet only forty-two percent of these farmers were responsible for 2.1 percent of the 109.2 million citrus cartons exported (CGA 2017; Genis 2018). This is in contrast to situations in other parts of the world, such as in China (Ji et al. 2016), Morocco (Dixon et al. 2009), Egypt (FAO et al. 2017) and Spain (Lambarraa and Serra 2007), where small-scale farmers run commercial citrus enterprises. In these countries, on average, the farm sizes ranges from 1-10 ha (Lowder and Skoet 2015).

In the face of recorded excellent performance, in particular, the ability to sell in export markets, among small-scale citrus producers in other parts of the world, there exists a need to investigate the factors that contribute to this success.

To date, several socio-economic studies conducted in South Africa dealt with trade-related issues and had focused on the interest of large-scale commercial producers. Except for the study by Ndou and Obi (2013) and Genis (2018), that partly addressed issues of small-scale citrus producers, the following studies by Seleka and Obi (2018), Sinngu and Antwi (2014), Peter and Coka (2017) and Dlikilili (2018), had as a focus, either on the competitive or the comparative advantage of the commercial citrus producers, in world trade.

Objectives

There are two objectives set out for the analyses in this paper. First, using multiclass discriminant analysis, the objective is to determine a combination of factors that enhances production and export capacity among selected countries practising small-scale citrus farming. Second, using literature review, to validate and corroborate the findings. Elements to be analysed include trends in production, export, imports, local consumption and farm size. The research question being asked is, in the face of stiff competition posed by countries with big farms, such as South Africa, what are the factors that enable small-scale citrus farmers in other countries to compete?

RESEARCH METHODOLOGY

This is a cross-country, comparison study that uses secondary data, derived from databas-

es and websites of credible organizations. Desktop research was conducted through an Internet search. Search engines of different publishing houses were explored. Other websites of agricultural and trade organisations, such as Food and Agriculture Organisation (FAO) and the World Bank were searched. The Scopus search engine was used to search for articles related to small-scale citrus farmers among countries involved in export of citrus. A maximum of 314 articles was accessed using standard and advanced searches. Through further filtering and refinement, using different keywords (for example, year of publication) and excluding titles related to biology and chemistry of citrus, only six articles remained in the results. The filtering process was extended to look into abstracts of the six articles, and these articles were found to be irrelevant.

Using the Agricultural Research Council, Library resources, the EBSCO Discovery Search engine, which also houses other search engines such as Scopus, an advanced literature search was conducted. Repeating the same procedure as in Scopus, 5,357 articles were accessed. Of this number, ten journal manuscripts were found to be relevant. Google Scholar was used to find more literature. In order to secure a balanced structure for the attributes under consideration and to secure time-series data, websites of credible organisations such as the ITC, and United States Department of Agriculture were explored. In order to corroborate the findings and results, the South African data captured in international organisations such as the Food and Agriculture Organisation of the United Nations (FAO) and the World Bank was verified using local resources such as records of the Department of Agriculture Forestry and Fisheries (DAFF) and Citrus Grower Association of Southern Africa (CGA).

Inclusion Criteria

Four approaches for including countries in the study sample were employed. First, the search focused on literature with countries whose farmers are operating farms that are less than 10 ha in extent but involved in the exportation of citrus. Second, based on the availability of data, a balanced mix between countries in the northern and southern hemispheres was explored. However, due to the lack of balanced data, the sample ended up with case studies of seven northern hemisphere countries and only three southern hemisphere countries.

Third, in order for the case study to be considered for the analyses, the information available had to cover at least eight attributes that were of interest in the study. The attributes included the following, that is, farm-size, level of rainfall, population size, yield, total volumes of citrus production, levels of exports, levels of import, and institutional support. In this regard, the capacity to export was used as a proxy for the "ability to produce good-quality fruit, given the stringent quality standards in E.U. markets. Volumes were consumed locally, and volumes of imports were used as a proxy for the local markets. The limitation of the study is that aggregate average data for a country does not necessarily reflect the performance at the farm level.

The fourth inclusion criteria had to do with the period of investigations, which was set in 1994 to 2016. This criterion was meant to, as in South Africa, consider the period after trade sanctions were lifted exclusively. However, due to the non-availability of balanced data across different countries, the analyses in the study covered the period 2008 to 2016. Based on the criteria set and the availability of the information, the following ten countries were considered for analyses, namely, Egypt, Morocco, Spain, China, India, Iran, Peru, Turkey, Chile and South Africa.

Exclusion Criteria

Only articles written in English were considered in the research. Literature with countries whose percentage of volumes exported was small at less than 0.1 percent, even when they met other aspects of the criteria were excluded in the analyses.

Data Analyses

Three methods of data analysis were employed. First, the study employed the multiclass discriminant analysis (DA) to determine a combination of production and trade factors, associated with countries, where small-scale farmers are exporting citrus. This method was chosen

due to its ability to handle small sample sizes, this being the case in the study. Second, descriptive statistics such as frequency tables, graphs and figures, were developed to draw relationships among different attributes being studied. Third, the literature review was used to substantiate and corroborate the findings and results.

Multiclass Discriminant Analyses (DA)

The Discriminant Analysis (DA) is a multivariate statistical technique representing a linear combination of two or more predictors that discriminate between the objects in the previously defined groups (Joseph et al. 2010). DA is used to estimate the linear relationship between a dependent variable with two or more categories and linear combinations of more independent variables (Johnson and Wichern 2007). In other words, DA is used to classify observations (dependent variables) and describing the relative importance of variables (independent variables) for distinguishing amongst groups. Assuming that the predictors are normally distributed (Gaussian distribution) and that the different classes have class-specific means and equal variance/covariance, the study will use generalised Fisher's linear discriminant (QDA) to find a linear combination of features that characterises or separates two or more classes of objects or events. QDA assumes that the density for X, given every class k is following a Gaussian distribution:

$$f_k(x) = \frac{1}{(2\pi)^{p/2}|\Sigma_k|^{1/2}} e^{-\frac{1}{2}(x-\mu_k)^T \Sigma_k^{-1}(x-\mu_k)}$$

Where, p is the dimension, π is the prior probability, and Σ_k is the covariance matrix. The function involves the square root of the determinant of the matrix. The vector x and the mean vector μ_k are both column vectors.

Then the QDA formula is given by:

$$\delta_k(x) = -\frac{1}{2}\log|\Sigma_k| - \frac{1}{2}(x-\mu_k)^T(x-\mu_k)T\Sigma_k^{-1}(x-\mu_k) + log\pi_k$$

Where, μ_K, Σ and π_k are mean, pooled variance, and proportion ok class k in the data.

The quadratic discriminant analysis was analysed using XLSTAT version 11.

The ten countries were subjected to DA with respect to five attributes, namely volumes of production, exports, processing and imports and the other attribute was population size. The multiclass discriminant analysis methods were run based on categorising figures for the volumes of exports and production into three classes. The classes for exports included first-class less than 100 thousand tons, the second class was between 100 and 1 million tons, and the third class was more than 1 million tons. The classes for production included, first, less than 2 million tons, the second one was between 2 million and 5 million tons, and the third class was more than 5 million tons.

RESULTS AND DISCUSSION

Multiclass Discriminant Analyses Results

Figure 1 presents the results of the multiclass discriminant analyses. According to the first column in Figure 1, China and India, on average, during the period 2008 to 2016, are more associated with producing more than 5 million tons of citrus mainly used for local consumption and processing. Based on 2016 statistics, this is despite farmers operating small plots of 2ha in extent. They export 100 thousand tons to 1 million tons of citrus. They are also associated with importing citrus fruits from other countries for selling locally. Egypt, Iran and Turkey are associated with producing 2 million to 5 million thousand tons of citrus. In 2016, the average farm size for Egypt was 5 ha, Iran was 4 ha and Turkey was 8 ha. The production of citrus in Egypt, Iran and Turkey is associated with total population. South Africa and Spain are associated with exporting more than 1 million tons of citrus. In South Africa, the average farm size is 72 ha in extent whereas that of Spain is 2.83 ha. Chile, Morocco, and Peru are associated with producing less than 2 million and export less than 100 thousand tons citrus. For Peru, the average farm size is 0.66 ha but for Morocco and Peru, this figure is 5 ha. In summary, the important attributes identified by the multiclass discriminant analyses tool, as drivers for export and production include capacity for high levels of production, processing, exports, population size and high rates of citrus consumption in local markets. These factors are discussed in the next sections.

Trends in Production, Important Determinant Factors

Table 1 presents the results for trends in production during the period 2008 and 2016. In terms

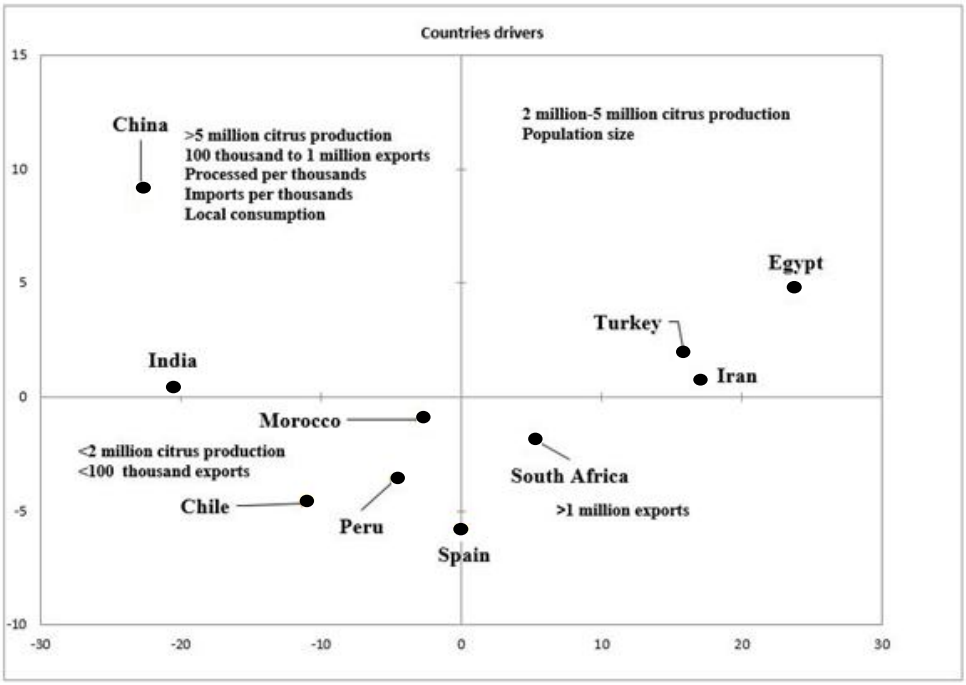

Fig. 1. Factors associated with countries involved in exportation of citrus
Source: Developed with data derived from FAO (2016a)

Table 1: Countries leading in production of citrus (thousand tons)

	2008	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
China	21 690	23 7310	23 975	28 9310	31 830	34 262	36 467	38 154	32 706
India	7 562	7 989	8 856	6 875	6 955	9 235	10 401	9 216	9 756
Spain	6 3610	5 268	6 076	5 720	5 554	6 686	7 042	6 101	6 882
Egypt	3 223	3 514	3 518	3 725	3 975	4 097	4 402	4 647	4 930
Iran	3 942	3 936	3 981	3 816	3 866	3 967	3 202	3 713	4 068
Turkey	3 024	3 511	3 570	3 612	3 473	3 679	3 781	3 803	3 652
South Africa	2 237	2 125	1 997	2 1690	2 134	2 1610	2 596	2 663	2 409
Morocco	1 093	1 093	1 346	1 636	1 867	1 452	2 214	1 899	2 019
Peru	806	756	853	885	948	995	1 026	1 101	1 112
Chile	326	297	287	300	301	304	275	287	282

Source: FAO (2016a)

of the results, by order of importance, the top three countries are China, India and Spain. In the study sample, China dominated with a figure of more than 32 thousand tons, this constituting forty-eight percent of the overall citrus produced by the ten countries in 2016. The second highest percentage is by India at 14.3 percent and Spain at ten percent. The share of South Africa is 3.5 percent in position seven, whereas other countries such as Chile, Peru and Morocco have small figures of anything between 0.4 percent and 2.9 percent. The figures for the percentage of exports derived from production among these countries are presented in Table 5 and discussed in detail in another section to follow. At least in terms of available information, comparative advantage of China and India has to do with available arable land for citrus pro-

duction and cheap labour. In Table 2, it can be seen that in 2016, the area put under citrus cultivation in India was 1.07 million ha (Chandra De 2017), for Egypt during the same period was 204,095 ha (Abobatta 2019), Spain, 121,405 ha (Futch and Singerman 2018) and 122,600 ha for Morocco (Oxford Business Group n.d.). For China, in 2012, the area put under citrus cultivation was 2.1 million ha (Spreen 2012). These figures contrast with that of South Africa, which was 72,731 ha, during the same period (DAFF 2017). Although South Africa cultivated the lesser amount of land, the ratio for cultivated area to volumes of production, shows that South Africa outcompetes the rest of the other six countries (see Table 2). The cultivated area to volumes of production was 33:1 for South Africa meaning that for every 1ha cultivated, an output of 33 tons of citrus was realised.

Table 2: The relationship between cultivated area and volumes of production

	Production (tons)	*Cultivated area (ha)*	*Cultivated area to production ratio*
South Africa	2 409 200	72731	33.1
China	32 705 900	1200000	27.2
Morocco	2 018 900	122600	16.5
India	9 755 800	1070000	9.1
Spain	6 882 000	121405	0.017
Egypt	4 930 400	204095	0.04

*Source:*FAO 2016a; Chandra De 2017; Abobatta 2019; Futch and Singerman 2018;Oxford Business Group undated; Spreen 2012; Lambarraa and Serra 2007

For China, this ratio was 27:1, Morocco 16:1, India 9:1, Spain 0.017:1 and Egypt 0.04:1. These results tend to suggest that although other countries have large tracks of land, when it comes to production efficiency they are not doing well and are outcompeted by South Africa. This finding was verified with data for trends in yield, as published on the FAO website. According to this website, in 2018 the average yield for citrus in South Africa was 45.6 tons per ha, of which when looking at the average of other nine countries, there was a gap of sixty percent. The good performance of South Africa, however tends to overshadow struggles faced by small-scale farmers and new entrant farmers who are the beneficiaries of the Land Reform programme. Based on limited information, in a business plan posted online by the Department of Agriculture, it is reported that citrus farmers in the Limpopo province of South Africa, operating the Makonde Lungane Citrus Estate, achieved yields of 10.5 ton to 18 ton/ha (DAFF undated). The Sibonelo Community Property Association, based in the Nelspruit-Mpumalanga province of South Africa, in 2014, only achieved yields of 26 tons/ha (CGA 2016b).

Still on the performance of other countries regarding yield, China came at position number 2, with a yield of 29.7 tons per ha, followed by Iran at 22.3 tons per ha at position number 3, and Peru and Spain at 19.7 and 18.3 tons per ha respectively, occupying position number 4 and 5. In China and India, despite these countries having huge tracks of lands for citrus cultivation and participating in export markets, the small sizes of farms, that is, 2ha, creates a situation where farmers remain trapped in poverty. In Zhi-dan et al. (2010), using the example of Hunan province in China, it is stated that citrus production is fragmented and derived from farms that are highly dispersed and situated in difficult hilly terrains. Families that are stuck in old traditional farming methods run a significant proportion of the farms. These methods are often associated with high transaction costs (In Zhi-dan et al. 2010).

According to Chapagain and Raizada (2017), in Asia, ten millions of smallholder farmers are poor and earn between one and two US Dollar per day. These farmers are unable to adopt modern agricultural technologies in the face of high levels of illiteracy (Chapagain and Raizada 2017). In FAO (2015), it is stated that many of the 3 billion people that live in about 475 million small farms, are poor and food insecure. As reported earlier in the paper, in South Africa, more than 2,000 small-scale citrus farmers, operating plots as small as 2 ha, are left in the periphery (Philp 2006), and not even considered commercial farmers. While there is no information regarding the plight of other farmers among the countries in the study sample, in many parts of the world the issue of the limitations posed by small farms, regarding low profitability, have been receiving policy attention. Just to give an example, according to Ji et al. (2016), since the mid-1990s, countries such as Korea, Japan and Taiwan have

been advocating for the enlargement of farms, but that, this is happening at a slower pace (Ji et al. 2016). This state of the affairs could also explain recent patterns of farm sizes between developing and developed countries. During the period 1960 to 2000, in most low and lower-middle-income countries, farm-sizes decreased, whereas among upper-middle-income countries, farm sizes increased (Lowder et al. 2015). In low-income countries, the decision to increase farm-sizes is informed by the fact that average farm sizes are already too low to sustain profitability. In IFPRI (2020), it is reported that half of the world's undernourished people, three-quarters of Africa's malnourished children, and the majority of people living in absolute poverty live on small farms. As of 2003, in China, the government introduced new policies that encouraged the consolidation of small farms into more significant operations (Ji et al. 2016).

As noted in FAO (2013), uniform and conventional farmer typologies are based on the farm size, among others, of which, to no small extent, is the case among the nine countries. This helps in ensuring that state-farmer-support programs are uniform. In South Africa, just like the structure of the agricultural sector, the support is dualistic (Gwebu and Matthews 2018). The problem of dualistic nature of the agricultural sector can be addressed by incorporating small-scale farmers and beneficiaries of land reform projects, into the mainstream commercial farmer associations and industry bodies. Except for South Africa and Chile wherein Lopez et al. (2017), the Producer Subsidy Equivalent (PSE), is said to be the lowest in the world, that is, at below three percent, the rest of the countries in the study sample, still administers high levels of agricultural subsidies. Among European farmers for instance, the PSE is nineteen percent, whereas in China it is close to fifteen percent (OECD 2018).

Returning to the issue of yield, it does not come as a surprise that countries with big farm-sizes realise high yields. Recent studies on total factor productivity tend to challenge the long-held view regarding the inverse relationship between farm-size and yield. According to Gollin (2018), for instance, there exists a disparity between developing and rich countries when it comes to the relationship between farm-size and yield. In rich countries, when big farms are well resourced with production inputs such as technology (for example, precision farming), fertiliser, mechanisation and labour, the per capita yield is high.

In Deininger and Byerlee (2012), an argument is made about how the expansion of farms into large operations has assisted countries such as Ukraine, Russia and Kazakhstan, achieve high yields. A recent study in Ghana, among rice producers that compared between farmers who used mechanisation and those who did not, have also reported high yields among those who mechanised (Apiors et al. 2016). A study by IFAD (2018) tends to demystify previous scientific studies that suggest that there is an inverse relationship between farm size and yield and caution that such studies had measurement errors. The study supports the notion of labour-output efficiency. This lends credence to situations regarding farmers in developing nations that happen to cultivate small plots but not able to use mechanisation and other forms of technology, and as a result, realising low yields (Deininger and Byerlee 2012). The policy directive for consolidation of small farms into big operations, remains a mammoth task, as in several developing countries, the size of a farm is used as a social safety security net and also for achieving equity among citizens (Ji et al. 2016). In Egypt, for instance, farmers that own less than two feddans (about 0.84 ha) are exempted from paying tax, this being a strategy to enhance farm-profitability (FAO 2017).

Rahnama (2013) posits that for Iran, a farm size of 4 ha, is big enough to enhance functional performance among farmers. The author cautions that this situation in Iran, in recent times, is threatened by the tendencies of families subdividing the farms into small portions and sharing it among children (Rahnama 2013).

Population Size, Local Consumption and Imports

In Table 3, the countries with high population size, by order of importance include China, which in 2016 had a population of 1.4 billion people, followed by India with a figure of 1.3 billion, and Egypt 95.6 million people. Iran and Turkey during the same period had population sizes of close to 80 million people. Spain and

Table 3: Imports in relation to population size, as a measure for the strength of local markets

		Imports (in thousands); Population size (in millions)								
Countries	*Attributes*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
Spain	Imports	269	170.7	217	166.5	204.2	164.2	179.1	271.6	267.4
	Population size	46.16	46.75	47.02	46.82	47.27	47.13	46.77	46.62	46.56
China	Imports	79.9	91.6	104.8	131.8	126	128.6	161.8	214.9	287
	Population size	1.325	1.331	1.338	1.344	1.351	1.357	1.364	1.371	1.379
Iran	Imports	32.6	66	70	124	196	169	189	180	190
	Population size	72.85	73.69	74.57	75.49	76.45	77.44	78.41	79.36	80.28
Turkey	Imports	38.6	50.3	39.2	56.6	47.5	50.6	49.6	70.8	64.4
	Population size	70.59	71.52	72.56	73.72	74.72	75.63	76.67	77.7	78.74
India	Imports	5	9.9	10.3	25.3	33.1	34.9	49.9	49.9	56.7
	Population size	1.197	1.214	1.231	1.247	1.263	1.279	1.214	1.307	1.324
South Africa	Imports	8.2	3.4	2.6	2.5	1.8	2.6	26.4	26.1	10.9
	Population size	50.4	50.97	51.58	52.26	53	53.77	54.54	55.29	56.02
Chile	Imports	1.9	3.1	9.4	10.8	6.1	8.7	10.5	6.8	6.6
	Population size	16.66	16.83	16.99	17.15	17.31	17.46	17.61	17.76	17.91
Peru	Imports	0	0	0	0.1	0.8	3.9	2.4	2.8	3.4
	Population size	28.64	29	29.37	29.76	30.16	30.57	30.97	31.38	31.77
Egypt	Imports	0.1	0	0.6	0.4	0.2	0	0.1	0	0.1
	Population size	80.95	82.47	84.11	85.9	87.81	89.81	91.81	93.78	95.69
Morocco	Imports	0	0	0	0	0	0	0	0	0
	Population size	31.6	31.99	32.41	32.86	33.33	33.82	34.32	34.8	35.28

Source: FAO 2016a

South Africa are comparable with figures of 46.56 and 56 million people, respectively, whereas Morocco had 35 million and Peru 31.7 million people. Chile has the lowest size of population of 17.9 million people. In China, India and Spain, the levels of citrus consumption in local markets and high population size, provides an incentive for local farmers to produce. This is because in export markets, small-scale farmers are exposed to stringent quality standards, which often attracts high transaction costs. According to Ren et al. (2020), going into the future, population size is one of the important factors, which would influence cooperation for food trade among the BRICS countries. In FAO (2017), it is stated that among other factors, family labour and cheap labour associated with small farms, reduces the cost of production.

In Table 3, results show that Spain, China, Turkey, India and Iran, by order of importance, maintained high rates of imports for citrus during the period under review. For China and India, this is because of the high population size that creates a high demand for citrus products.

For Spain and Turkey, high rates of imports emanates from high per-capita consumption of fruit per person. These results concur with generally published literature that shows that fruit consumption rates, are high in Europe and low in other regions of the world, in particular in Africa. As an example, in South Africa, male adults consume 235 grams per day of vegetables and fruits. Women consume 226 grams per day, and these figures are lower than the threshold set by the World Health Organisation, which is 400g per person per day (Naude 2013). This low intake has to do with low household income and the per capita high cost of fruit and vegetables (Naude 2013). In the least developed countries located in Sub-Saharan Africa (SSA) where there is a high incidence of micronutrient deficiency, there is less consumption of citrus products (Kaminski et al. 2014). In this region, poor people, on average, consume 8 grams of citrus fruit per person per day, and this is six times less than the world average.

In contrast, in the U.S. the consumption of citrus fruit is estimated at 147 grams per person per day (Turner and Burri 2013). A high rate of consumption of fruits in local markets strengthens the demand for the products and builds a high premium price for the commodities. The 2011 report by International Trade Centre shows that growing income levels among Chinese consum-

ers, coupled with the growing demand for organic fruit, results in high premium prices for fruit.

Trends in Exports, the Percentage Exported as a Proportion of Volumes Produced

Table 4 presents the results for the trends in exports. When it comes to volumes of exports, by order of importance, Spain, South Africa, Turkey and China are on the lead. For the period 2008 to 2016, Spain has consistently occupied position one, followed by South Africa in position two. Based on volumes, in 2016 Spain exported 4,114 thousand tons of citrus, South Africa 1,701 thousand tons and Egypt 1,387 thousand tons. Turkey and Egypt had high figures of 1,495 thousand tons and Morocco 524 thousand tons. China and India, despite its high levels of volumes of production, only exported 683 thousand tons and 123 thousand tons, respectively. Iran, Peru and Chile were the worst performers with figures of 9.38 and 250 thousand tons, respectively. Using the criteria of volumes exported, and everything remaining the same, the researchers draw two lessons. First, the counter-seasonal effect, associated with the country being in the southern hemisphere, this being the situation for South Africa, provides export competitiveness. With Chile and Peru even when they are in the Southern Hemisphere, they are outcompeted by South Africa, as its farms are relatively big and it has an advantage of high crop yield. Second, proximity to the European market, this being a situation for Morocco, Egypt, Turkey and Spain, serves as another advantage. In Table 5, it can be seen that in 2016, Chile exported 88.7 percent of the total citrus it produced in that year. For South Africa this figure was 70.6 percent, Spain 59.8 percent, Turkey 40.9 percent and Egypt 28.1 percent. In the work of De-Miguel et al. (2019), although it is accepted that citrus farm-sizes in Spain, that is, 2.83 ha, are relatively small, it is stated that adoption of good cultural practices at farm level assist the country in attaining export competitiveness. Such cultural practices include adoption of drip irrigation systems, efficient fertiliser programs and adoption of varieties that respond to consumer taste and preferences. Furthermore, since

Table 4: Countries leading in exportation of citrus (Thousand tons)

	South Africa	*Peru*	*Chile*	*Spain*	*Egypt*	*Morocco*	*Turkey*	*China*	*India*	*Iran*
2008	1 520	67	103	3 211	565	563	825	820	91	7
2009	1 300	47	109	3 492	871	410	1 0960	1 085	87	16
2010	1 299	69	139	3 265	868	439	1 223	931	92	36
2011	1 476	84	158	3 695	1 086	432	1 495	900	105	33
2012	1 420	94	167	3 926	1 412	332	1 226	1 080	86	50
2013	1 486	43	169	3 882	884	521	1 239	1 039	67	51
2014	1 644	44	158	4 271	929	516	1 337	977	103	11
2015	1 675	41	210	3 644	1 473	584	1 618	917	1110	19
2016	1 701	38	250	4 114	1 387	524	1 495	683	123	9

Source: FAO (2016a)

Table 5: Percentage exported as a proportion of volumes produced

	South Africa	*Peru*	*Chile*	*Spain*	*Egypt*	*Morocco*	*Turkey*	*China*	*India*	*Iran*
2008	67.9	8.3	31.5	50.4	17.5	51.5	27.3	3.8	1.2	0.2
2009	61.2	6.2	36.8	66.3	24.8	37.5	31.2	4.6	1.1	0.4
2010	65.0	8.1	48.5	53.7	24.7	32.6	34.3	3.9	1.0	0.9
2011	68.0	9.5	52.8	64.6	29.1	26.4	41.4	3.1	1.5	0.9
2012	66.6	9.9	55.5	70.7	35.5	17.8	35.3	3.4	1.2	1.3
2013	68.5	4.3	55.6	58.1	21.6	35.9	33.7	3.0	0.7	1.3
2014	63.3	4.3	57.4	60.6	21.1	23.3	35.4	2.7	1.0	0.4
2015	62.9	3.7	73.4	59.7	31.7	30.7	42.5	2.4	1.3	0.5
2016	70.6	3.4	88.7	59.8	28.1	26.0	40.9	2.1	1.3	0.2

Source: FAO (2016a)

Spain is situated in the European Union, it enjoys preferential trade treaties such as the free movement of products of agricultural origin (Fidan 2009).

In South Africa, as reported earlier in the paper, big sizes of farms and high crop yield are important factors that enhance export competitiveness. Other critical factors for export competitiveness among South African farmers include the counter-seasonal effects with European Countries (Mili 2016), whereby the country can supply citrus during seasons when farmers in Europe are unable to do so. The availability of seaports and good transport infrastructure (Baker and Morgan 2012), cheap migrant labour, and efficient transport and logistic systems (Dlikilili 2018) are other factors for export-competitiveness. The good performance, however, overshadows the struggles faced by the small-scale citrus farmers who do not have the necessary resources to realise the right quality products for export markets (Genis 2018). Turkey, although it has small farms of 8 ha on average and low crop yield of 12.2 tons (see Table 6), since it is based in Europe, which happens to be the biggest market for fruit, it enjoys the trade policy treaty within Europe, that allows for free movements of goods of agricultural origin (Fidan 2009). Chile and Peru, even when situated in the Southern Hemisphere, the rates of exports in these countries in relative terms are low. According to Partida (2011) and Sinngu (2014), this is mainly due to competition they face from other Southern Hemisphere countries such as South Africa and Australia.

Table 6: Statistics for production factors among ten countries

	Rainfall	*Average farm size*	*Yield*
SA	495	72	45.6
Spain	636	2.83	18.3
Morocco	346	5	9.7
Chile	1522	0.66	22
Peru	1738	5	19.7
China	645	2	29.7
India	1083	2	13.93
Turkey	593	8	12.2
Iran	228	4	22.3
Egypt	51	5	14.98

Source: FAO (2016a); FAO website

CONCLUSION

The objective of the analyses in the paper is to determine a combination of factors. Multiclass Discriminant analysis was used as a statistical tool, to determine a combination of factors associated with countries, where small-scale citrus producers are exporting citrus. Among the 10 countries considered in the study sample, six factors were found to be important in influencing production and exportation of citrus products. These include population size, the rate of consumption for citrus in local markets, availability of arable land for citrus, processing capacity, proximity to European markets and the counter-seasonal effect with European Union markets. South Africa enjoys a special competitive advantage, which has to do with big sizes of farms and high crop yield, whereas Spain and Turkey are favoured by the preferential trade-treaty within the EU. This treaty allows for the free movement of goods of agricultural origin. The income derived from small farms such as those of China and India, is small such that even when farmers are able to export citrus, they still remain trapped in poverty. Based on the discussions and conclusions in the paper, there still exists a room for future studies to look into the sustainability of governments providing subsidies for small citrus farms.

RECOMMENDATIONS

As a policy recommendation, there exists a need for determining a viable size of a citrus farm, which will sustain farmers' livelihoods. Governments of countries, where citrus is produced under small-scale, needs to revitalise and strengthen local markets through promotion for local consumption. This will create a readily available market for local producers.

ACKNOWLEDGMENTS

The following people and stakeholders are acknowledged, Cynthia Ngwane, Sandile Mahlangu, and Sedzani Nemakhavani for the different administrative functions. Lebogang Raphadu offered technical support. The Agricultural Research Council of South Africa funded the study.

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Paper received for publication in June, 2020
Paper accepted for publication in July, 2020