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CURRENT STATUS AND ISSUES OF SOILLESS SUBSTRATE USAGE IN ORNAMENTAL NURSERY PRODUCTION BUSINESS IN PUNJAB, PAKISTAN

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A survey-based study was conducted to analyze the current scenario of substrate usage in local ornamental plants nurseries of Punjab, Pakistan, during 2017, using stratified random sampling technique. Ornamental nurseries of Faisalabad, Lahore, Islamabad, Kasur and Multan were surveyed on a detailed questionnaire, which consisted of comprehensive personal and business information of nurserymen, substrate usage for ornamental plant production and major issues of nursery production business in Punjab, Pakistan. Collected data were coded, decoded and arranged statistically in tabular form, and were analyzed through SPSS (Statistical Package for Social Science) IBM (International Business Machines) version 19. Results demonstrated that majority of local nurserymen were using soil or silt for raising ornamentals. Moreover, major obstacle in nursery production was the unawareness of the nurserymen regarding modern nursery raising techniques and majority (56%) even had no idea about use or significance of soilless substrates. However, a large number (62%) of nurserymen were interested to produce export quality plants, using cheaper local soilless substrates, if available at affordable prices. Only a few nurserymen, who were using modern imported substrates, demanded the tax exemption facility (35%) and reduction of import export barriers (21%), training of labor about modern substrates and nursery raising techniques (21%) and awareness about modern technologies (16%). Ignorance about modern soilless substrates (53%) and high costs of imported soilless substrates (25%) were reported to be the major issues in limited use of soilless substrates. Nurserymen also complained that they were using personal resources only to cope with their nursery issues and no support was available from public or private sector. Nurserymen were purchasing the traditional substrates, viz. silt from other nurserymen (48%), and get some guidance from university experts, floriculture websites or through floriculture department extension agents. Use of garden soil or silt traditionally and unawareness of the modern soilless substrates were reported as major reasons of low quality nursery production and nurserymen were looking for affordable locally developed soilless substrates for better quality ornamental nursery production.

Keywords: Intensive agriculture, nursery production, growing media, seedling production, potted ornamentals.

INTRODUCTION

Nursery production is of prime importance for the bedding and potted ornamentals and is one of the specialized examples of intensive agriculture, which involves the use of renewable and local resources to maximize plant growth and quality. In Pakistan, majority of nurserymen are using garden soil or silt traditionally as growing substrates for nursery production and raising potted ornamentals. Use of garden soil for nursery production is not suitable because it may cause soil borne disease attack and hinder quality production (Ahmad *et al*., 2012; Jacobs *et al*., 2009). Utilization of agricultural by-products, as a substrate component and nutrient source, has attained an additional significance and response in floriculture worldwide to produce superior quality ornamental plants (Grigatti, 2008). But in Pakistan, nurserymen are still using traditional garden soil or silt as substrate, which is one of major reason of low quality plant production.

Generally, soilless substrates have proven to be very suitable for nursery production and are regarded as environment friendly (Schnitzler and Gruda, 2002). Development of local substrates, instead of imported products, is of great importance because imported substrates are quite expensive and there is social pressure and demand to reuse the agricultural wastes (Raviv, 2011; Abad, 2001). Very little research has been conducted locally in our country so far on exploring the potential of developing local sustainable soilless substrates in Pakistan. However, higher costs of imported soilless substrates have led to a search for identifying and developing suitable alternative growth medium for raising high quality plants.

There is need to identify and develop economic and sustainable soilless substrates using local waste components for providing substrates to the local nurserymen. Therefore, a survey was conducted at different ornamental nurseries in Punjab region to investigate the current status of substrate usage in the local nurseries, to identify their issues regarding substrate, plant production and marketing and developing different strategies to cope with their issues.

MATERIALS AND METHODS

A study was conducted in various ornamental nursery production areas of Punjab, Pakistan, by surveying ornamental plant nurseries. A list of nurserymen was prepared by visiting nursery farms and complete demographic information of nurserymen was recorded. In total, 200 nurseries in selected study areas were found, out of which 120 nurseries were randomly selected. First, nurseries were visited to collect basic information regarding substrate use and nursery production techniques. Complete business profile of nurserymen was recorded, and nurserymen were selected randomly from five districts of Punjab, viz. Kasur, Lahore, Multan, Faisalabad, and Rawalpindi. Initially, a pilot survey was conducted to acquire the basic information and understanding of the questions and response of nurserymen, business profile and nursery raising techniques being used by local nurserymen. A structured questionnaire was developed to get detailed information about developing of business profiles and research attributes. Nurserymen were interviewed on a detailed questionnaire, which was initially prepared in English and translated into Urdu for the convenience of nurserymen and each interview lasted 20-30 min.

A profile of each nurseryman was prepared in which biographical data, educational level, business experience, type of ownership, area under nursery, number of employees and involvement of family members were recorded. Nurserymen were asked about substrates being used for nursery production, sources of information regarding substrate usage and availability of substrates being used in the market. Sources of locally available substrates were questioned, and nurserymen were inquired about their problems and facilities required to flourish their nursery business. Nurserymen were also questioned about problems associated with the traditional soil usage as substrate and role of different government institutes and private organizations to solve their problems.

Collected data were coded, decoded, arranged in tabular form and analyzed through SPSS (Statistical Package for Social Science) IBM (International Business Machines) version 19. Statistical differences were tested for various attributes at 5% probability level (Levesque, 2005).

RESULTS AND DISCUSSION

Survey findings depicted that majority of nurserymen in study areas were not aware about soilless substrates and were using traditionally used garden soil or silt for raising nursery plants. However, young generation of the local nurserymen were more educated with family business experience and were eager to learn and use soilless substrates for quality plant production. A good proportion of nurserymen in Punjab (48.6%) were graduate, followed by 37% having a secondary school certificate and 13.2% had basic education.

***Business profile*:** Survey results depicted that there is good sign of young entrepreneurs in nursery business with 35% having less than 10 years of experience, while 37% were running their family business with more than 20 years in this business (Table 1). Among nurserymen in Faisalabad, 40% were well educated graduates, 40% had secondary school certificate, and 20% were illiterate. In Lahore, Islamabad, Kasur and Multan, majority of the nurserymen (60, 51, 49 and 43%, respectively) were graduate followed by the those who held secondary school certificates (33, 38, 36 and 43%, respectively), while rest of them were illiterate (Table 1). In Multan, 86% nursery owners were running their business for the last 1-10 years, while in Kasur 44% nurserymen were found to be involved in nursery business for over 20 years. In Rawalpindi and Islamabad, 46% of the nurserymen started their business 10-20 years ago (Table 1).

Among age of nurserymen in this business, 67% young entrepreneurs were involved in this business in Islamabad, while in Multan (71%), Kasur (62%) and Faisalabad (60%). Whereas, in Lahore, 67% nurserymen were over 40 years old, who were running this business efficiently. Nursery business was being owned by the individual persons (46.3%) or in the partnership (35.9%) followed by the nurserymen who were running their nursery as family business for a longer time (23.9%), while rest of small number of nurserymen were running this business on rent or as a corporation. In Faisalabad, nurserymen either preferred to run their business by their own (40%) or they had their family business (40%). Very few of them (20%) were running their business in the partnership with other persons. Whereas in Lahore, majority of nurserymen (67%) were running their business in partnership with other persons or by engaging their own family members (20%). In Islamabad, 43% nurserymen had individual business, 13% had their family members engaged with them and 38% had partnership with other persons. Only 3% were running this business on rent or as a corporation. In Kasur and Multan, majority (49 and 86%, respectively) were running their business by their own followed by engaging their own family members (33%).

Majority of nurserymen (50%) had 1-4 kanals of nursery area, 44% had more than one-acre area of their nurseries, whereas a few nurseries (6%) had an area of less than 4 kanals (Table 1). In Kasur, majority (66%) of nurserymen had big size nurseries with more than one acre of area under their nurseries, whereas in Multan, Lahore and Islamabad, majority of the nurserymen had 1-4 kanal land under their nursery (86, 67 and 67%, respectively).

Nursery business is a full time business demanding proper care right from seed sowing till harvest or marketing. Therefore, nurserymen may require several labourer's to deal with routine tasks. Majority (67%) of nurserymen had 1-5 labourers, followed by 22% who had 6 or more labourers,

Table 1. Demographic information of ornamental nurseries surveyed in five major cities of Punjab, Pakistan, randomly selected through stratified random sampling technique; Data stratification based on education and age of the owner, number of years the business has been in operation, nursery size and number of laborers at nursery.

Personal	Faisalabad		Lahore		Rawalpindi/Islamabad		Kasur		Multan	
Information	**n**	**(%)**	**n**	**(%)**	**N**	**(%)**	**n**	**(%)**	**n**	**(%)**
Education										
Illiterate	1	20	1	6.7	4	10.3	8	14.5	1	14.4
Matric	2	40	4	26.8	15	38.55	20	36.4	3	42.8
Graduate or more	2	40	9	60.3	20	51.2	27	49.1	3	42.8
Age										
20-40	3	60	5	33.3	26	66.7	34	61.9	5	71.5
40 or more	2	40	10	66.6	13	33.3	21	38.1	2	28.5
Business Experience										
1-10 years	1	20	3	20	11	28.2	13	23.7	6	85.7
10-20 years	2	40	6	40	18	46.2	18	32.7	1	14.3
More than 20 years	2	40	6	40	10	25.6	24	43.6	-	-
Type of Ownership										
Individual	2	40	2	13.3	17	43.6	27	49.1	6	85.7
Family	2	40	3	20	5	12.8	18	32.7	1	14.3
Partnership	1	20	10	66.7	15	38.5	10	18.2	-	-
Rent	-	-	-	-	1	2.6	-	-	-	-
Corporation	-	-	-	-	1	2.6	-	-	-	-
Nursery Area										
Less than 1 Kanal	-	-	1	6.7	2	5.1	2	3.6	1	14.3
1-4 Kanal	2	40	10	66.6	26	66.7	17	30.9	6	85.7
1 Acre or more	3	60	4	26.7	11	28.2	36	65.4	-	-
Laborers at Nursery										
No Servants	-	-	1	6.7	9	23.1	2	3.6	3	42.8
1-5	4	80	10	66.6	23	59.0	39	70.9	4	57.2
6 or more	1	20	4	26.7	7	17.9	14	25.4	-	-

while rest of nurserymen were self-dependent and tackled their nursey business by themselves involving their family members only (Table 1). All the nurserymen were in the favor of family member involvement in the nursery business for their support. In Faisalabad, 80% of nurseries required 1-5 persons, while 20% had engaged more than 6 labourers. Similar trend was noticed in other cities, where survey was conducted. Majority of nurserymen had only 1-5 workers to look after their nurseries, comprising of 67% nurseries in Lahore, 59% in Islamabad, 71% in Kasur and 57% in Multan. Only a few nurserymen were running their nurseries by their own without having labourers (Table 1).

These findings revealed that there is good trend of engagement of young generation in nursery business, who are more educated and have access to modern technologies and are eager to improve their business. These finding show a positive change in our nursery sector, which would be helpful for promotion of nursery production in the country.

***Substrate usage*:** Survey results demonstrated that in Punjab, Pakistan, most of the nurserymen are still working with the traditional soil or silt and about half of nurserymen are not aware about use of soilless substrates for nursery raising and plant propagation. Majority (>90%) was using silt with farm yard manure as a source of nutrients to the ornamental crops, whereas only a couple of nurserymen were using modern substrate in ratio with the local one on a small scale. In different nurseries, various ratios (1:2, 1:3 and 1:4) of farmyard manure (FYM)/compost: silt/soil were used to prepare substrates by volume. According to this survey, majority of nurserymen in all the cities were using 1 part FYM and 3 parts silt on an average *viz.*, Faisalabad (80%), Lahore (47%), Islamabad (64%), Kasur (45%) and Multan (43%). General response of nurserymen towards the self-preparation of growing substrate at their nursery was not good. The main advantages of pasteurized soilless substrate are the use of same site for years, controlled micro-climate of greenhouse with heat and frost protection, and fast growth of plants after transplantation in the field due to undisturbed and vigorous root system (Khan *et al*., 2006).

Nurserymen, in Islamabad and Lahore, were not aware of the need for substrate analysis to assess their nutritional value. Only 7.7% of them were willing to analyze their substrates. Nurserymen in Islamabad were using peat moss as imported substrate and nitrophos fertilizer for providing nutrients for

high valued ornamental crops propagation. In Lahore, along with use of peat moss in fewer nurseries, fertilizers of many types were in use, e.g. nitrophos, organic fertilizer and urea (Data not presented).

Nursery business was being run by using traditional nursery raising technologies and majority of nurserymen (56.4%) were using traditional substrates, viz. soil or silt and were not aware of modern substrates used worldwide. This trend was also common in Faisalabad (80.0%), Islamabad (56.4%) and Multan (71.5%). The situation was totally opposite in other cities, including Lahore (73.3%) and Kasur (52.7%), where majority of nurserymen were themselves interested in preparation of their own substrate to save their capital (Fig. 1A). These nurserymen were using garden soil of poor quality along with farm yard manure and/or fertilizer as nursery raising substrate. Nurserymen, who were preparing their own substrate in this way, preferred to prepare their own substrate at their nursery to avoid extra capital requirement and were also interested in marketing of their substrate product to other nurseries or companies or ornamental nursery related businesses (Data not presented).

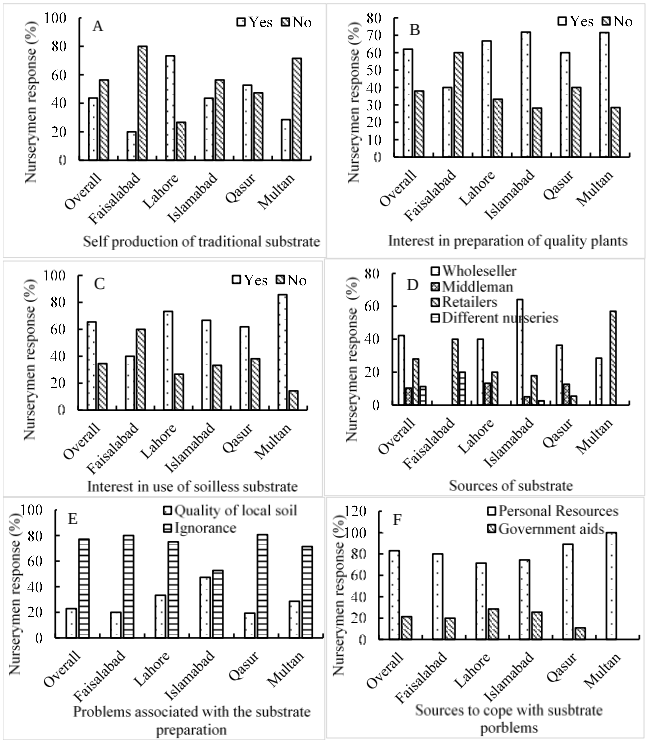

Figure 1. Response of nurserymen towards self-production of traditional substrates (A), interest in preparation of quality plants (B), interest in use of soilless substrate (C), sources for substrate (D), problem associated with substrate preparation (E), and sources to cope with substrate problems (F).

Good quality plants were being produced at different nurseries in Punjab, however, these plants are not exportable because of their production in soil or silt, which pose quarantine issues during export. However, 62% of nurserymen were interested to produce export quality plants, rest of them were just relying on local plant production and did not show any interest in plants export (Fig. 1B). Nurserymen can increase their business profitability by enhancing area under nursery production and by production of greater number of best quality plants (Zubair and Saleem, 2010). Nurserymen (65%) were interested in use of soilless substrate, whereas rest of them did not show any concern in the use of soilless substrate. Plants prepared in the nurseries were either sent to the local markets within the city (49%), to intercity markets (34%) or direct to the companies or housing societies (22%). About 40% of Lahore nurseries were selling plants to other cities, while nurseries in Faisalabad (60%), Islamabad (59%), Kasur (40%) and Multan (57.2%) were selling plants in the local markets. Similarly, a large proportion of nurserymen was not interested in exporting the plants and many of them (60%) were not interested to use modern soilless substrate according to modern era demand, as shown in Fig. 1C. Wide range of soilless substrates is in use for vegetable production as well, some of which are naturally occurring while others are produced artificially (Verdock *et al*., 1982; Olle *et al*., 2012; Bhat *et al*., 2013). Soilless substrates include organic materials such as wastes compost, tree bark, coconut fiber, rice hulls or ash, peat moss or other inorganic materials such as vermiculite and perlite (Grunert *et al*., 2008; Nair *et al*., 2011; Vaughn *et al*., 2011).

Generally, substrates were being marketed through wholesalers (42.3%), followed by retailers (28.1%), whereas rest of them were relying on middlemen (10.4%) and other nursery owners (11.3%). Mostly the substrate was marketed to other nurserymen or other cities in packaging comprised of 100 Kg of substrates. As an overall response, majority of nurserymen marketed their products through wholesalers (42.3%), retailers (28.1%) and middlemen (10.4%). In Faisalabad, majority (40%) of nurserymen was marketing substrate though retailers, whereas in Lahore, wholesalers (40%) and retailers (20%) were marketing substrates. Wholesalers were also serving as main channel for substrate marketing in Islamabad (64%) and Kasur (36%), whereas in Multan, retailers were the main marketing distributers (57%) as shown in Figure 1D.

Ignorance regarding use of modern techniques for nursery raising (77%) and poor quality local soil (23%) were reported as major issues in soilless substrate use and nursery production in Punjab, Pakistan. In Faisalabad, nurserymen were mainly dealing with the common ornamental plants and majority was just focusing on the nursery raising of seasonal ornamental flowers for display and were ignoring the basic requirements of the nearby markets. They were also unaware of the modern substrates (80%) and were using traditional

substrate (silt: farm yard manure) for nursery raising. In Lahore, majority was using traditional methods for plant propagation and most nurserymen were unaware of the use of modern substrates for this purpose (Fig. 1E).

Nurserymen were self-dependent enough to cope with their nursery and substrate issues (82.9%), whereas few of them (19.1%) got government aids as well. To tackle the substrate related issues, majority of nurserymen (82.9%) were using their personal resources, while a few of them were getting help from government institutes (21.3%), still having the personal resource as the main source to solve the problems in Faisalabad (80%), Lahore (71.4%), Islamabad (74.4%), Multan (100%) and Kasur (89.1%) (Fig. 1F).

Majority of nurserymen (47%) were not using any advertising strategy for locally available substrate marketing. However, a few of them were using different medium *viz*., newspaper advertisement (8.1%), internet advertisement (7.1%), phone calls (24.1%), social media (14%) and nursery websites (5.9%). In Faisalabad and Lahore, majority of nurserymen were not using any advertising strategy (40 and 53.3%, respectively), while a few of them were using newspaper advertisement and phone calls in Faisalabad (20% each), and internet advertisement and nursery websites (13.3% each). Whereas, majority of the nurserymen (57.1%) in Multan said that no strategy was being opted for advertising and remaining (42.9%) opted phone calls for this purpose (Fig. 2A).

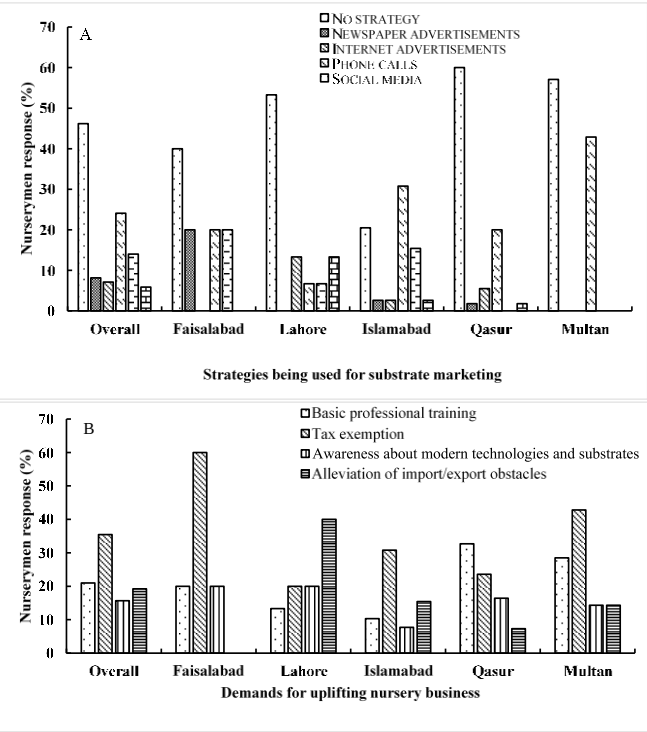

Figure 2. Response of nurserymen towards strategies being used for substrate marketing (A) and demands for uplifting nursery business (B).

Nurserymen demanded provision of facilities for promotion of their businesses, which included basic professional training (20.9%), awareness about modern technologies (15.7%) and alleviation of import/export obstacles. Import export hurdles and taxes were the major reason in Lahore, Faisalabad and Islamabad (40 and 60, 30.8%, respectively), while in Kasur and Multan, nurserymen did not seem to have any special demand to flourish their nursery business (Fig. 2B).

Majority of plants produced at surveyed nurseries were marketed to local markets (48.6%), followed by intercity markets (34.2%) and direct to companies or housing societies (21.5%). In Lahore, plants were mainly sent to the other cities (40%), while in Faisalabad, Islamabad, Kasur and Multan, plants were mainly marketed in the local markets (60, 59, 40 and 57%, respectively) (Fig. 3A).

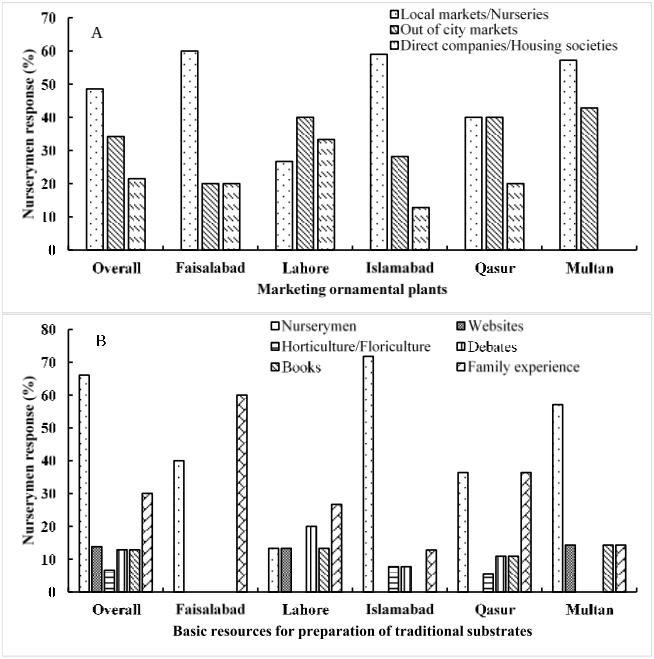

Figure 3. Marketing of ornamental plants (A) and basic resources for traditional substrate preparation (B).

Ignorance regarding use of soilless substrates and their possible alternate components available locally was the major reason of using soil and silt in all the surveyed cities. Nurserymen were having just a little information regarding the use of modern substrates used for plant propagation and for potted plant production. On the other hand, majority of them (37.9%) were getting information for media or substrate preparation from other nurserymen (66.1%), who were growing ornamental plants for seasonal use, followed by nurserymen using their family experience (30.0%) to prepare the substrates at nurseries by their own. Very little information was available through horticultural magazines

(6.2%), debates (12.9%) and books (12.8%), as presented in Figure 3B.

***Conclusion*:** Currently, majority of nurserymen were using soil or silt for raising plants and were unaware about soilless substrates. However, majority is willing to use soilless substrates if available locally at affordable prices and provide better results than soil or silt. Major constraints included lack of technical skills for soilless substrate usage, ignorance of modern substrates being used, and high cost of imported substrates. Therefore, there is need to develop locally available, cheaper and sustainable substrate using agricultural wastes for better quality nursery production. Moreover, policies should be developed for promoting soilless substrate use and capacity building of nurserymen for producing export quality plants and to cope with quarantine issues.

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