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Awareness on horticultural composite products: A comparative study

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Abstract

The growth of agricultural esp. horticultural related composite market has become a dire necessity. This will be beneficial for the environment by reducing the amount of resources and energy used for production and at the same time, consuming a significant amount of waste generated from these sectors as raw materials in the production of bio-composites. Awareness on horticultural composite products has become a critical area of research, especially in the context of sustainable agriculture and environmental conservation. This study aims to evaluate the consumers' awareness level and buying behavior towards horticultural related composite products. It was conducted in Grand Nursery Mela-2024 organised in Hyderabad on 60 consumers and 30 shopkeepers between 18-70 years of age. Simple random sampling method was used to collect the samples. Data was collected via offline survey method and further evaluated by percentage, frequency and correlation method. The study perceived that there was less awareness among both shopkeepers and consumers regarding composite products. There was a significant positive correlation between awareness level and education qualification of the consumers whereas in case of shopkeeper's awareness level was positively related to number of years of experience in business.

Keywords: Horticultural products, gardening composites, pots/planters, plant supporting stick, propagation tray, mulching film, green house covers

1. Introduction

Composites are defined as materials that are composed of two or more physically and chemically different phases separated by an interface. The different systems are combined carefully to achieve a system with more useful structural or functional properties non attainable by any of these compositions alone (Shaw *et al.*, 2010) [7]. There are two types of materials that make up composites: they include the matrix (binding materials) and the reinforcement materials. Either of these types of materials is required to produce a composite material (Statista Research Department, 2024). The first evidence of the use of composites can be traced back to early Egyptians and Mesopotamian settlers, who built sturdy and long-lasting structures by mixing mud and straw in the 1500 B.C. (Nagavally, 2016) [6]. Since then the production and use of composites has been eventually increasing with the highest use in the construction segment. According to a survey the volume of the composite materials market in construction segment was estimated to be 3.3 million metric tons in 2021, an increase of 50 per cent in comparison to 2010. By 2026, the sector's market volume is forecast to reach 3.8 million tons. Meanwhile, for consumer goods segment an increase of roughly 67 per cent between 2010 and 2021 was experienced, with an expected market volume of 1.2 million metric tons by 2026 (Statista Research Department, 2023) at the same time the U.S. market value of composites is forecasted to increase to 17.3 billion U.S. dollars in 2024 (Statista Research Department, 2024).

It has been found that comparatively less composite production is being done for agricultural related products as compared to other sectors. Agricultural esp. horticultural equipment can also become a growing market for composites (Composite World, 2019). This can be proved beneficial for the environment by reducing the amount of resources and energy used for production and at the same time, consuming a significant amount of waste generated from these sectors as raw materials. Awareness on horticultural composite products has become a critical area of research, especially in the context of sustainable agriculture and environmental conservation. As the world suffers with issues related to food safety, waste reduction, and ecological impact, understanding how composite materials can enhance horticultural practices is essential.

Post-harvest loss of horticultural products remains a significant concern globally. Factors such as microbial contamination, over-ripening, transit losses, and secondary infections due to pests and borers contribute to this loss. Traditional storage methods, including paper and plastic boxes, have limitations in addressing these challenges. For instance plastics derived from petroleum, plastic is not a renewable resource and contains toxic compounds harmful to the environment (Choudhury *et al.*, 2019) [1] while paper derived from trees, its extensive demand leads to deforestation, raising sustainability concerns (Das *et al.*, 2020) [2]. To meet the urgent demand production, use and most significantly spreading awareness of composites (esp. bio-composites) will surely turn out to be a beneficial step. In this article, we will be highlighting the awareness level of some important horticultural composite products among both the consumers and shopkeepers.

Hypothesis of the study

- **H1**: There is significant positive relation between the education level of respondents and their awareness on composite products.
- **H2**: There is positive relationship between the number of years in business related to horticulture and awareness about the related composite products.

Objectives of the study

General objective

To test the general awareness in public regarding the composite materials used for horticultural applications.

Specific objectives

- To find out the awareness of respondents about composite materials used in horticulture.
- To know the usage pattern of composite products among the respondents.
- To test the knowledge on market availability of composite products related to horticulture among the respondents.
- To analyse the awareness level of respondents about the types of raw materials used for composite manufacturing.
- To identify the knowledge among respondents regarding eco-friendly composites available in the market.
- To know the knowledge of labelling and standardisation of composites among respondents.

2. Methodology

An exploratory research method was adopted for the study, wherein the sample comprised 90 respondents i.e. 60 consumers & 30 shopkeepers related to horticultural background were taken. The respondents were selected using a random sampling method. The data was collected using a structured questionnaire which included the awareness level and buying behavior of the respondents. The data was analysed using frequencies, percentages, and correlation methods and the results are presented in the following section.

3. Results and Discussion

3.1 Demographic information of respondents

Table 1: Demographic information of the respondents

Variable type	Categories	Percentage of Respondents	
		Consumers n=60	Shopkeepers/Sellers n=30
Gender	Male	25	93.3
	Female	75	6.7
Age (years)	18-25	13.3	10
	26-35	20	46.7
	36-45	16.7	36.7
	46-55	18.3	6.7
	56 and above	31.7	Nil
Educational Qualification	Illiterate	0	Nil
	Primary education	0	Nil
	Middle School	0	3.3
	High school	10	13.3
	Intermediate	18.3	60
	Graduation	41.7	20
	Post-graduation	28.3	Nil
	Ph. D	1.7	Nil
Occupation	Self-employed	13.3	90
	Homemaker	40	Nil
	Farmer	3.3	3.3
	Retired	18.3	Nil
	Artisan	8.3	6.7
	Student	16.7	Nil
Monthly income (₹)	Up to 5,00,000	10	26.7
	5,00,001-10,00,000	36.7	43.3
	Above 10,00,001	53.3	30
Location of residence	Rural	5	Nil
	Semi-urban	5	40
	Urban	75	23.3
	Metro	15	3.3
Type of business	Nursery	_	30
	Garden center	_	16.7
	Home and garden store	_	53.3
Years of business	Less than 1 year	_	Nil
	1-5 years	_	20

	6-10 years	_	33.3
	More than 10 years	_	46.7
Size of business	Small scale	_	13.3
	Medium scale	_	63.3
	Large scale		23.3

3.1.1 Gender
The majority of the customers were female (75%), while the shopkeepers/sellers were male (93.3%).

3.1.2 Age (in years)
Amongst the consumers a major portion was above 56 years old (31.7%), while shop keepers/ sellers were between 26-35 years (46.7%).

3.1.3 Educational qualification
Educational qualification varies significantly between the two study groups. The majority of consumers were graduates (41.70%), while the majority of shopkeepers/sellers have an intermediate level of education (60%). None of the respondents in either group were illiterate or have only primary education.

3.1.4 Occupation
A little less than half (40%) of consumers were homemakers, while 90% of shopkeepers/sellers were self-employed.

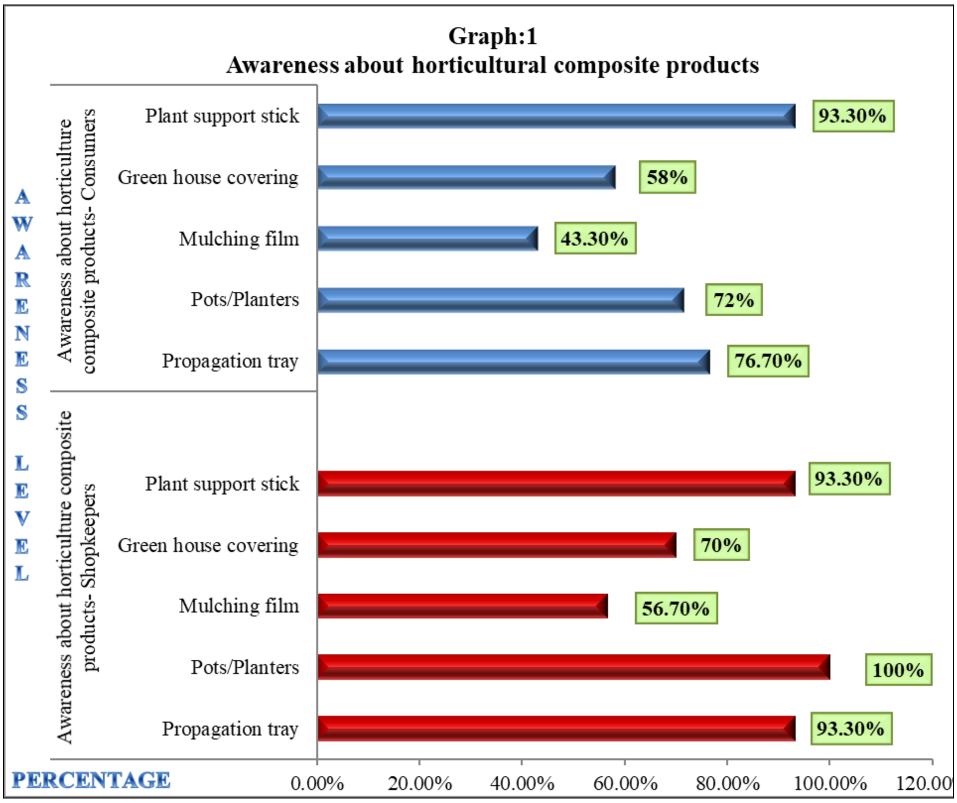
3.1.5 Monthly income
More than half of the consumers (53.30%) earned above ₹10,00,001, while the majority of shopkeepers/sellers earned between ₹5,00,001-10,00,000 (43.30%).

3.1.6 Location of residence
Most consumers resided in urban areas (75%), while shopkeepers/sellers are mostly located in semi-urban areas (40%). Hence shopkeepers use the local shandies, mela's and exhibition platforms to meet potential consumers which were observed by the researcher in the mela.

3.1.7 Business type, size and years
The majority of shopkeepers/sellers run home and garden stores (53.30%). Most businesses have been operating for more than 10 years (46.70%) and are of medium scale (63.30%).

3.2 Awareness about horticultural composite products among respondents
Graph 1 gives data about the awareness of different horticulture composite products among shopkeepers and consumers. Most consumers were aware of plant supporting sticks (93.30%), followed by propagation trays (76.7%), pots/planters (72%). More than half (58%) of the consumers knew about green-house coverings and less than half (43.3%) were aware of mulching films. Cent per cent of the shopkeepers knew of pots/planters, 90% were aware of propagation trays and plant support sticks. About 70% knew about green-house coverings followed by slightly more than half (56.7%) were aware of mulching films.

In comparison, shopkeepers had higher awareness of most products than consumers, except for plant supporting sticks where the level of awareness is equal. This could be due to the fact that shopkeepers need to know about the products they're selling, while consumers only need to know about the products they use. The equal awareness for plant support sticks could suggest that it's a commonly used product in horticulture.

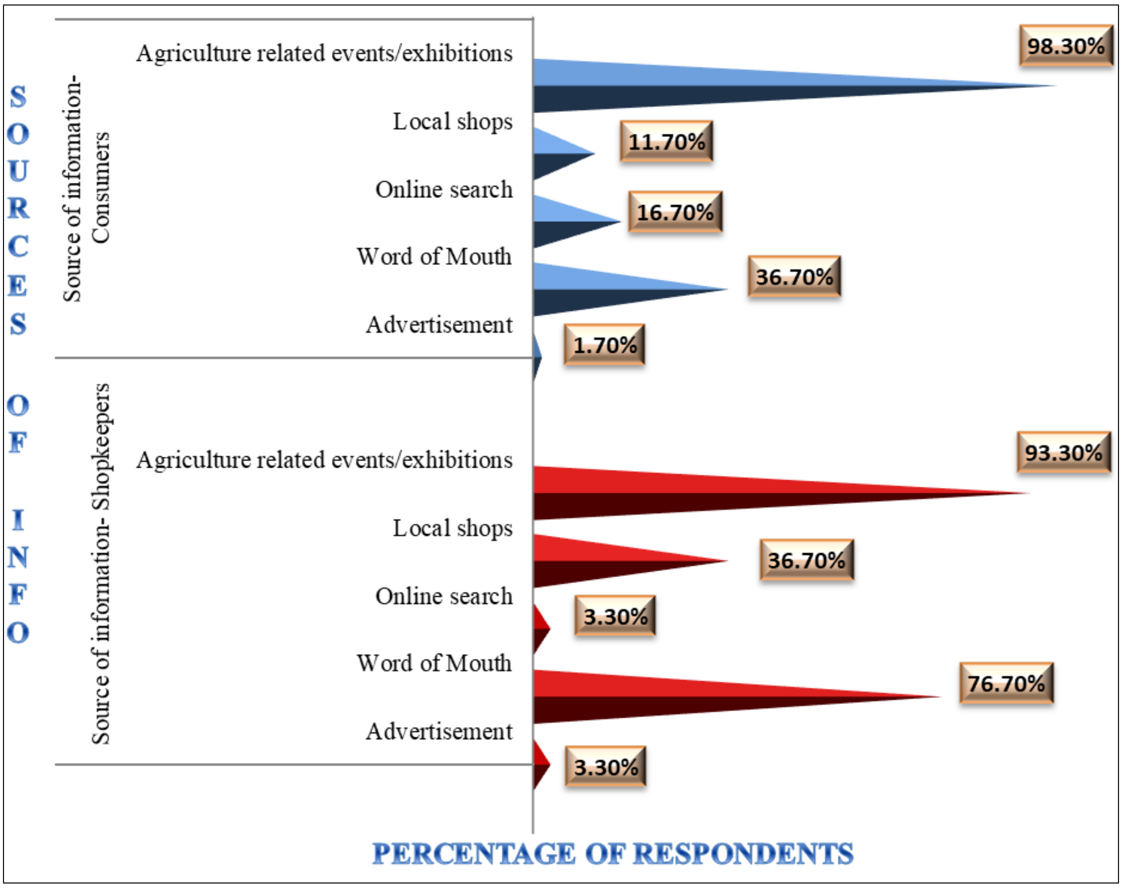


Graph 1: Awareness about horticultural composite products

3.2.1 Sources of information

The data regarding the sources of information for consumers and shopkeepers about horticulture composite products is presented in Graph 2**.** Agriculture related events/exhibitions (98.3%) were the major source of information for consumers, followed by word of mouth (36.7%). Online search (16.7%) and local shops (11.7%) were also sources of information. Interestingly, advertisement appeared to be the least effective source of information for consumers (1.7%). Shopkeepers also gained information through agriculture related events/exhibitions, (93.3%). They depended also on word of mouth as a source of information about new products (76.7%). They enhanced their knowledge by visiting local shops (36.7%). Advertisement and Online search were the least effective sources of information for shopkeepers, (3.3% each).

In conclusion, agriculture related events/exhibitions were the most effective source of information for both consumers and shopkeepers. Word of Mouth is much more effective for shopkeepers than for consumers. Advertisements and Online searches were the least effective sources of information for both the groups. This could suggest that more traditional, personal methods of information dissemination are more effective in this field. It could also suggest that efforts to increase consumer knowledge about these products should focus on improving the effectiveness of online searches and advertisements.

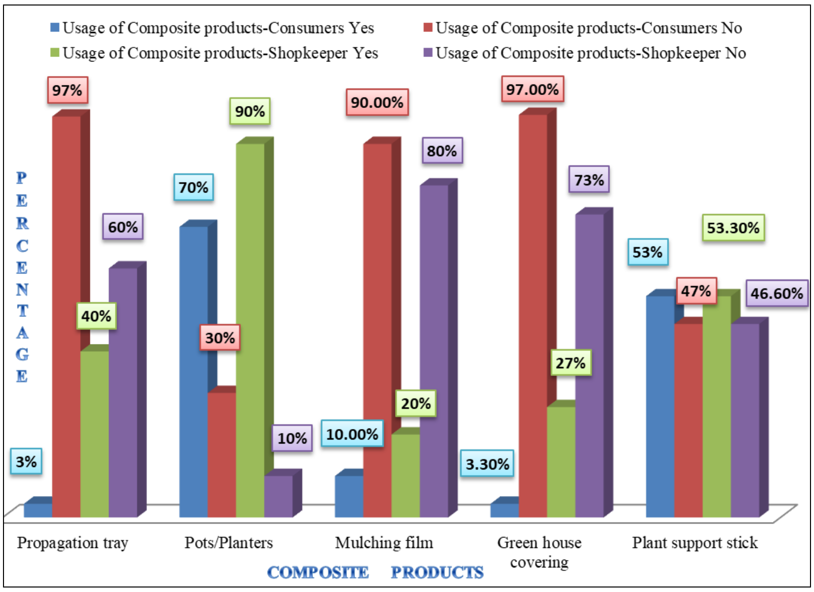


Graph 2: Sources of Information

3.3 Usage of horticulture composite products

The graph provides insights into the adoption rates for various products:

In terms of propogation tray, only 3% of consumers used propagation trays while 40% of shopkeepers used them in their nurseries. A substantial number (70%) of consumers utilized pots or planters, while most shopkeepers (90 %) used them for propogation of plants in their regular work. When it comes to mulching film, only 10% of consumers and 20% of shopkeepers have used. Green house covering was used by 3.30% of consumers and 27% of shopkeepers. Plant support stick was used almost equally by both the consumers (53%) and shopkeepers (53.30%). Hence, it can be concluded that the usage pattern of the five items were pots or planters > plant support stick > propogation tray > green house covering > mulching film.



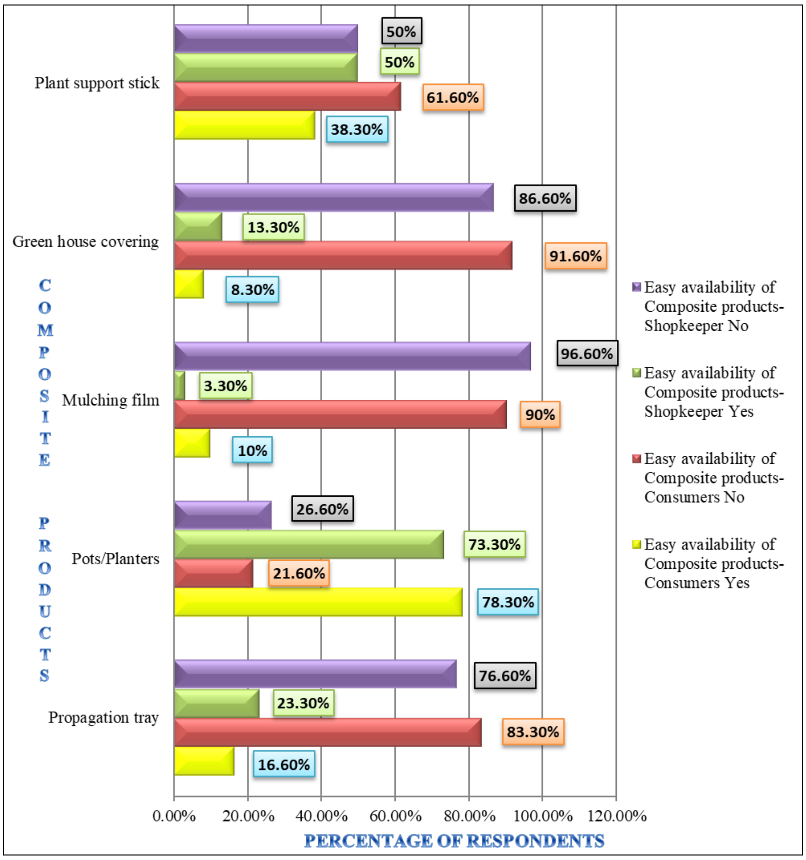
Graph 3: Usage of Composite products

3.4 Availability assessment of composites in the market

The data provided in the graph 4 presents information on the perceived availability of various composite products among two groups: consumers and shopkeepers.

Both consumers and shopkeepers indicate that pot planters were available easily (78.30% & 73.30%) in the market, followed by plant support stick (50% & 38.30%), propagation tray (23.30% and 16.60%), greenhouse covering (13.30% and 8.30%) and lastly mulching film (3.30% and 10%).

It can be concluded that some composite products like pots/planters are readily available, others like propagation trays, mulching films, and greenhouse coverings are not easily available according to both consumers and shopkeepers. This highlights potential areas for improvement in the supply chain of these composite products. The availability of the items can be represented as pots or planters > plant support stick > propogation tray > green house covering > mulching film.



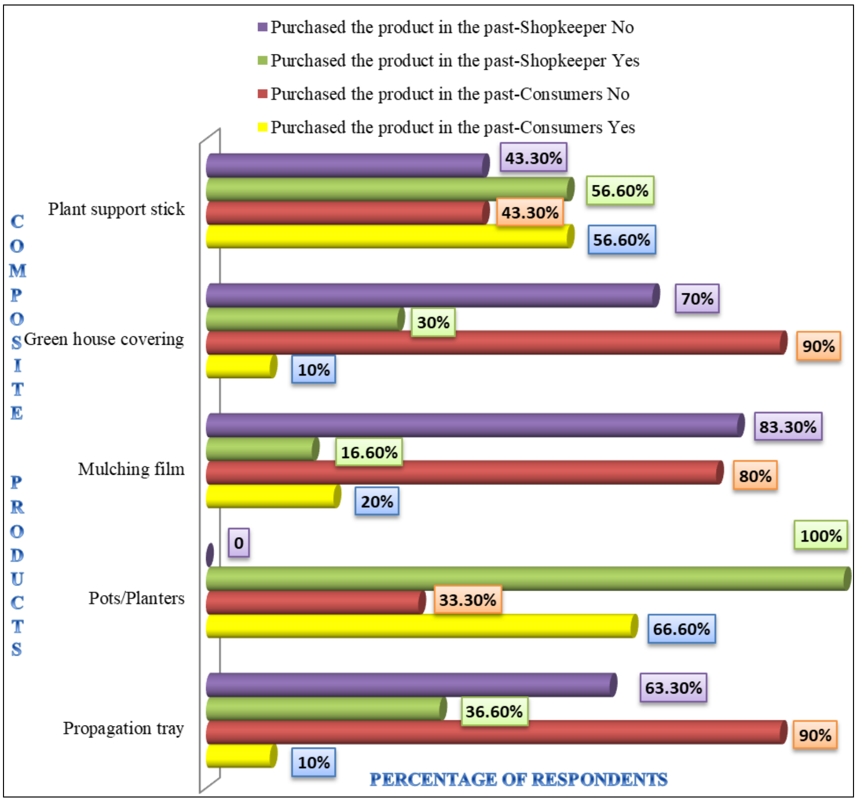
Graph 4: Easy availability of Composites

3.4.1 Products purchased in the past by both shop keepers and consumers

The data presents information on the past purchases of various composite products among two groups: consumers and shopkeepers.

Only 10% of consumers have purchased propagation trays in the past, while a significant 90% have not. Consumers showed a higher purchasing rate for pots and planters, with 66.60% having bought them. However, 33.30% have not. Approximately 20% of consumers have purchased mulching film, while 80% have not. Similar to propagation trays, only 10% of consumers have purchased greenhouse coverings, with 90% not having done so. Around 56.60% of consumers have purchased plant support sticks, while 43.30% have not. Shopkeepers have a higher purchasing rate for propagation trays, with 36.60% having bought them. However, 63.30% have not. All shopkeepers have purchased pots and planters (100%). Shopkeepers showed a lower purchasing rate for mulching film (16.60%) compared to consumers. Greenhouse coverings have been purchased by 30% of shopkeepers, while 70% have not. Similar to consumers, around 56.60% of shopkeepers have purchased plant support sticks, while 43.30% have not.

In summation, the order of products in terms of past purchase is as follows: pots or planters > plant support stick > propogation tray > green house covering > mulching film.



Graph 5: Product purchased in the past

3.4.2 Sources of information, challenges and desirable features in Composite Products

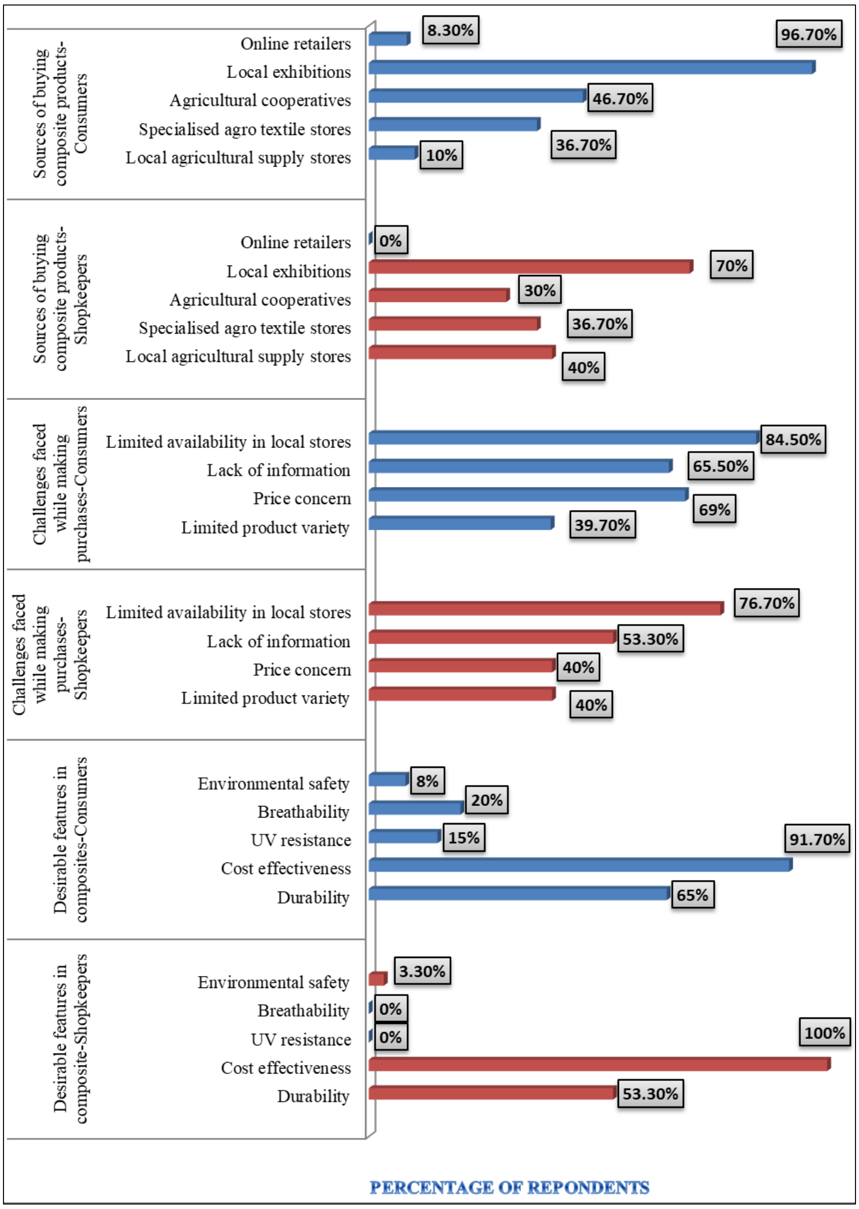
The data presents information on the sources of buying composite products, challenges faced while making purchases, and desirable features in composites for two groups: consumers and shopkeepers.

In terms of sources for buying composite products, the consumers' most preferred places were local exhibitions (96.7%), followed by agricultural cooperatives (46.7%) and specialized agro textile stores (36.7%). On the other hand, shopkeepers preferred local exhibitions (70%), local agricultural supply stores (40%), and specialized agro textile stores (36.7%).

When it comes to challenges faced while making purchases, the major issue cited by the consumers was limited availability in local stores (84.5%), Other issues were price concerns (69%) and lack of information (65.5%) and limited variety (39.70%). Similarly, shopkeepers also faced challenges with limited availability in local stores (76.7%), but they equally cited limited product variety and price concerns (both 40%) as significant challenges. In addition, lack of information on product variety (53.30%) appeared to be a limiting factor for procurement and selling.

Regarding desirable features in composites, both consumers and shop keepers focused on cost effectiveness – shop keepers (100%) to maximize their profits by having more profit margin, while consumers (91.7 %) want to spend less on the products. Durability was also ranked equally important by both the study groups – durable products increase sales for the shop keepers (53.30%), while consumers (65%) want their products to last for the longest time. Shop keepers do not seem to focus on UV resistance and breathability, as well as environmental safety. Consumers, on the other hand, gave importance to breathability (20%), UV resistance (15%) and environmental safety (8%).

In conclusion, the data suggests that while there are commonalities in the sources of buying composite products and challenges faced, there are significant differences in the importance placed on various features of composites between consumers and shopkeepers.



Graph 6: Sources of information, challenges and desirable features in Composite Products

3.5 Awareness on manufacturing process of composites

The data represents the understanding and familiarity with the manufacturing process of composite products for gardening among consumers and shopkeepers.

Most of the shopkeepers (40%) were knowledgeable about the manufacturing process, while the majority (60%) were not. When asked about the rating of their understanding levels, only 3% of the shopkeepers were very knowledgeable, while 33.3% were somewhat knowledgeable. However, a significant majority (63%) were not knowledgeable about the process.

In contrast, a significant majority of consumers (80%) claimed familiarity with the manufacturing process of composites, leaving only 20% unfamiliar. The consumers rated their level of understanding - a small percentage (4%) was very knowledgeable about the manufacturing process, while 24.6% were somewhat knowledgeable. However, a large majority (72%) were not knowledgeable about the process.

In general, both consumers and shopkeepers have a low level of understanding about the manufacturing process of composite products for gardening, with shopkeepers being slightly more knowledgeable. However, consumers claim a higher level of familiarity with the process compared to shopkeepers. This could suggest that while many consumers and shopkeepers use or sell these products, they may not fully understand how they are made. This could also indicate a potential need for more education and transparency about the manufacturing process in this industry.

3.5.1 Awareness on raw materials for composite manufacturing

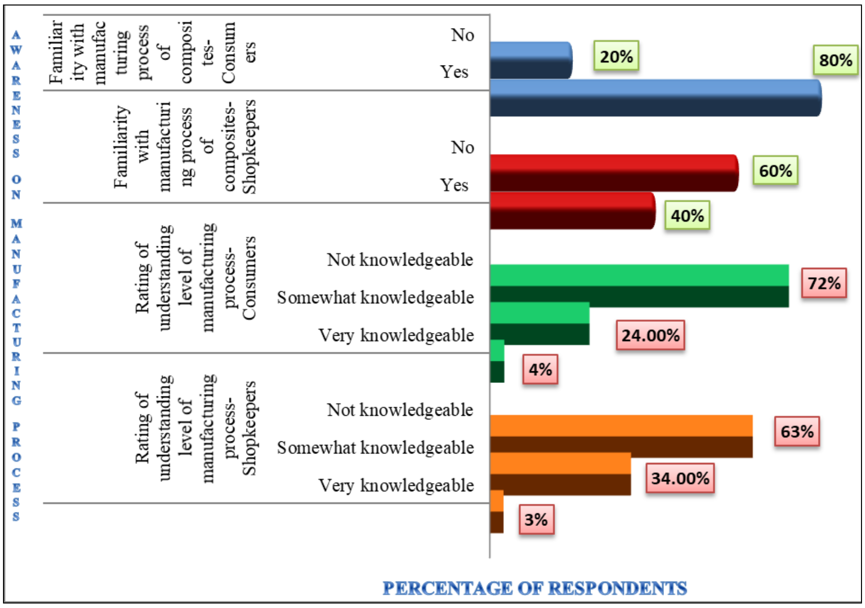
The data represents the awareness of various matrices and fiber materials among shopkeepers and consumers.

For fiber materials: Among consumers, glass fiber was the most recognized fiber material with a high 96.1% awareness. Natural fibers and Carbon fiber were also well recognized with 66.7% and 64.7% awareness respectively. Aramid fiber was less recognized with 27.5% awareness. Among shopkeepers, glass fiber was the most recognized fiber material with 70% awareness. Natural fibers and

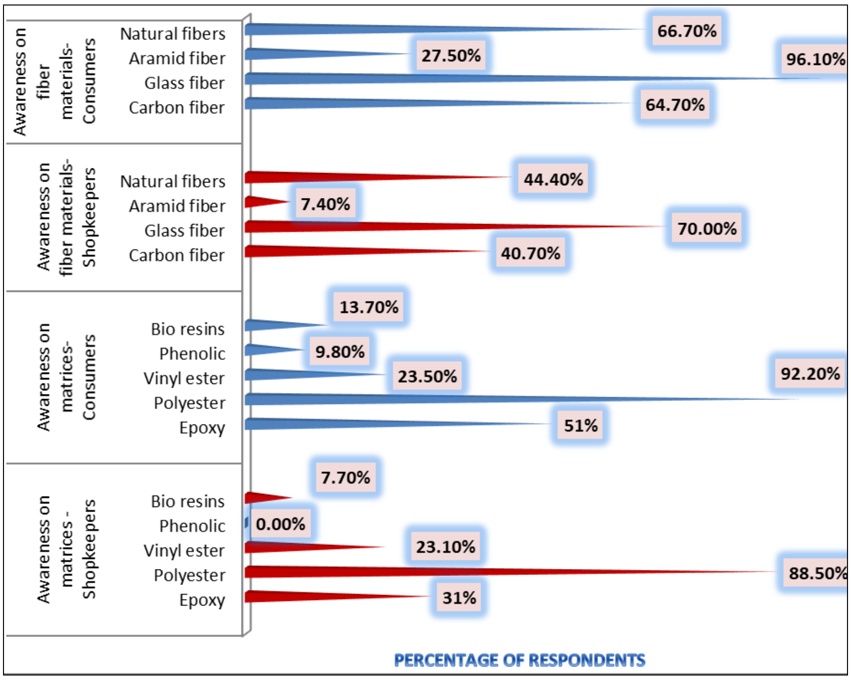
Carbon fiber followed with 44.4% and 40.7% awareness respectively. Aramid fiber was the least recognized with only 7.4% awareness.

For matrices, among consumers, polyester was also the most recognized matrix with 92.2% awareness. Epoxy followed with 51% awareness, and vinyl ester was recognized by 23.5% of consumers. Phenolic and bio resins were less recognized with 9.8% and 13.7% awareness respectively. Among shopkeepers, polyester was the most recognized matrix with 88.5% awareness, followed by epoxy at 31%, and vinyl ester at 23.1%. Phenolic had no awareness, and bio resins were the least recognized with only 7.7% awareness.

It was interesting to note that both study groups were aware of glass fibre being used in composite manufacturing as well as that polyester was the principal fibre component of composite matrices. Phenolic and aramid fibers were the least recognized among the matrices and fiber materials respectively. This could suggest that these materials are either not well-known or not commonly used in the market.



Graph 7: Awareness on Manufacturing Process of Composites



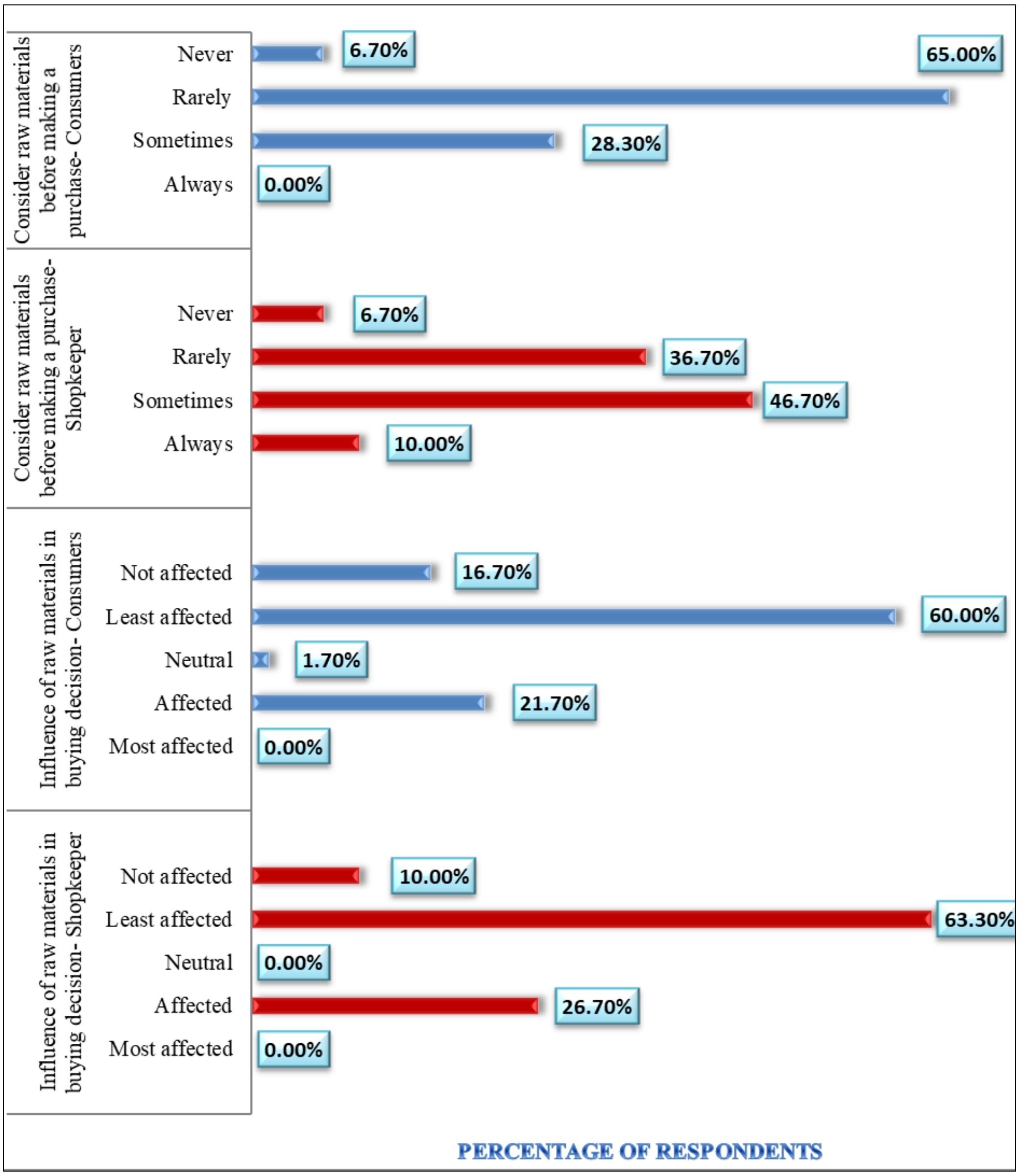
Graph 8: Awareness on raw materials for Composite manufacturing

3.5.2 Awareness of raw material and buying behaviour

The data represents the influence of raw materials in the buying decision and the consideration of raw materials before making a purchase among shopkeepers and consumers.

Consumers rarely looked at raw material of the products they were purchasing (65%) while some did pay attention to the raw material composition (28.30%). Shopkeepers sometimes looked at raw materials while stocking items in their store (46.70%) while only a 10% of them were diligent in checking the raw material composition of the products they purchased. An equal percentage (6.70%) of both the shopkeepers and consumers never looked at raw material of the product during purchase.

Data regarding the influence of raw materials on the buying behaviour of composite products was also elicited from both the study groups, who indicated that composition of the product least affected their buying behaviour (60% for consumers and 63.30% for shopkeepers). An almost similar percentage of consumers (21.70%) and shopkeepers (26.70%) have indicated that raw material composition has influenced their buying decision. More number of consumers (16.70%) seem not be affected by the raw materials while deciding on what products to buy while 10% of the shopkeepers indicated that raw material composition did not affect their choice of composite products. This could suggest that other factors, such as price, brand, and quality, may have a greater influence on their buying decision.



Graph 9: Awareness of Raw material and Buying Behavior

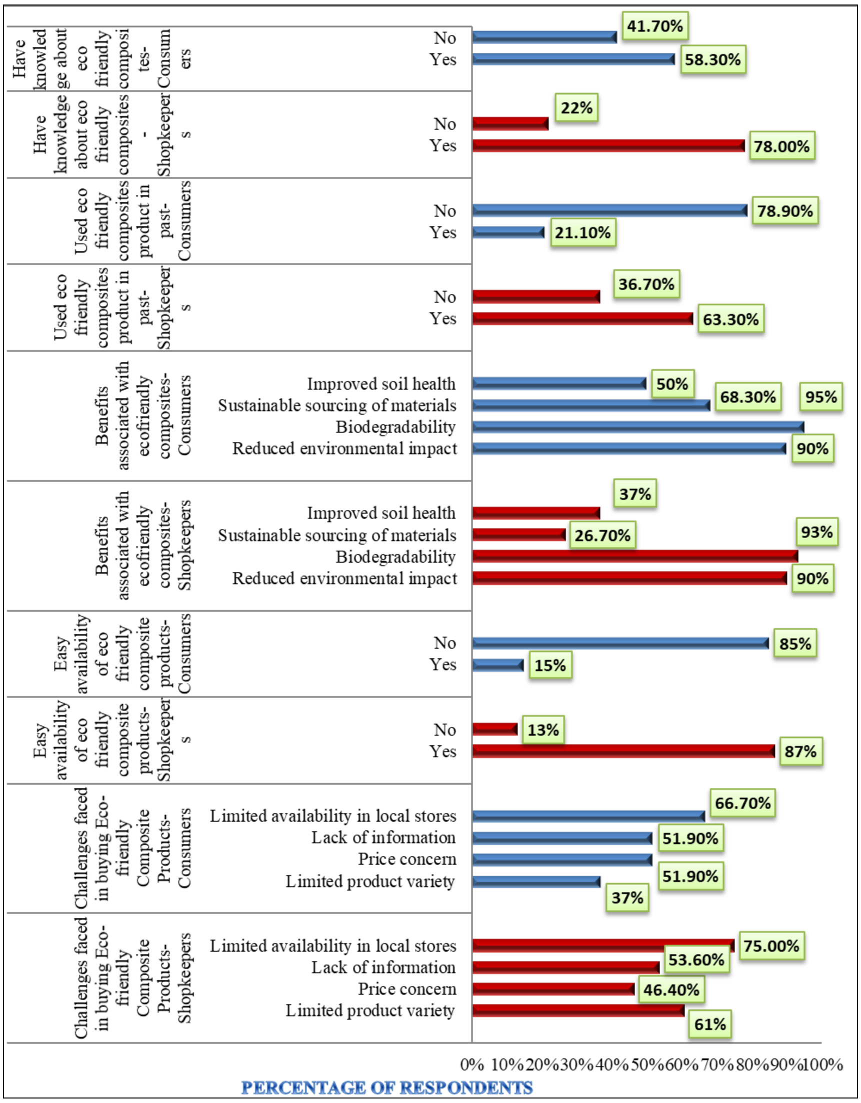
3.6 Awareness about eco-friendly composite products

The data represents various aspects related to eco-friendly composite products among two groups.

- **Knowledge about eco-friendly composites:** A significant majority of both groups (78% of consumers and 58.3% of shopkeepers) claim to have knowledge about these products.
- **Past usage of eco-friendly composites:** More than half (63.3%) of the shopkeepers had used these products in the past, while a majority (78.9%) of the consumers had not.
- **Benefits of eco-friendly composites:** The majority of both groups recognized the biodegradability (95% of consumers and 93% of shopkeepers) and reduced environmental impact (90% each of consumers and shopkeepers) of these products as major benefits. However, fewer people were aware of their sustainable sourcing of materials and their contribution to improved soil health.
- **Availability of eco-friendly composite products:** There was a stark contrast between the two groups. Majority, 87% of the shopkeepers found these products

easily available, while 85% of the consumers were unable to avail them easily.

- **Challenges in buying eco-friendly composite products:** The most significant challenge for both groups was the limited availability in local stores (75% and 66.7% of the shopkeepers and consumers respectively). The second most common challenge was the limited product variety, faced by 61% of the shopkeepers and 37% of the consumers. Price concern and lack of information were also notable challenges, with slightly more than half of each group expressing these concerns.
- Hence, it can be summed up that while there is awareness and knowledge about eco-friendly composite products, their usage is not as widespread, possibly due to challenges such as limited availability, product variety, and price concerns. This suggests a need for increasing the accessibility and affordability of these products to the common man. Here lies an opportunity for the sector to promote their usage among the public.



Graph 10: Awareness about Eco-friendly Composite Products

3.7 Awareness on labeling of composite products

The data provided presents information on the awareness and familiarity of various eco-friendly signs, symbols, and labelling of composite materials.

It shows an increase in familiarity with labelling of composite materials from 56.7% (shopkeepers) to 78.3% (consumers) in two different datasets. This suggests an increasing trend in the understanding and recognition of eco-friendly practices in material production.

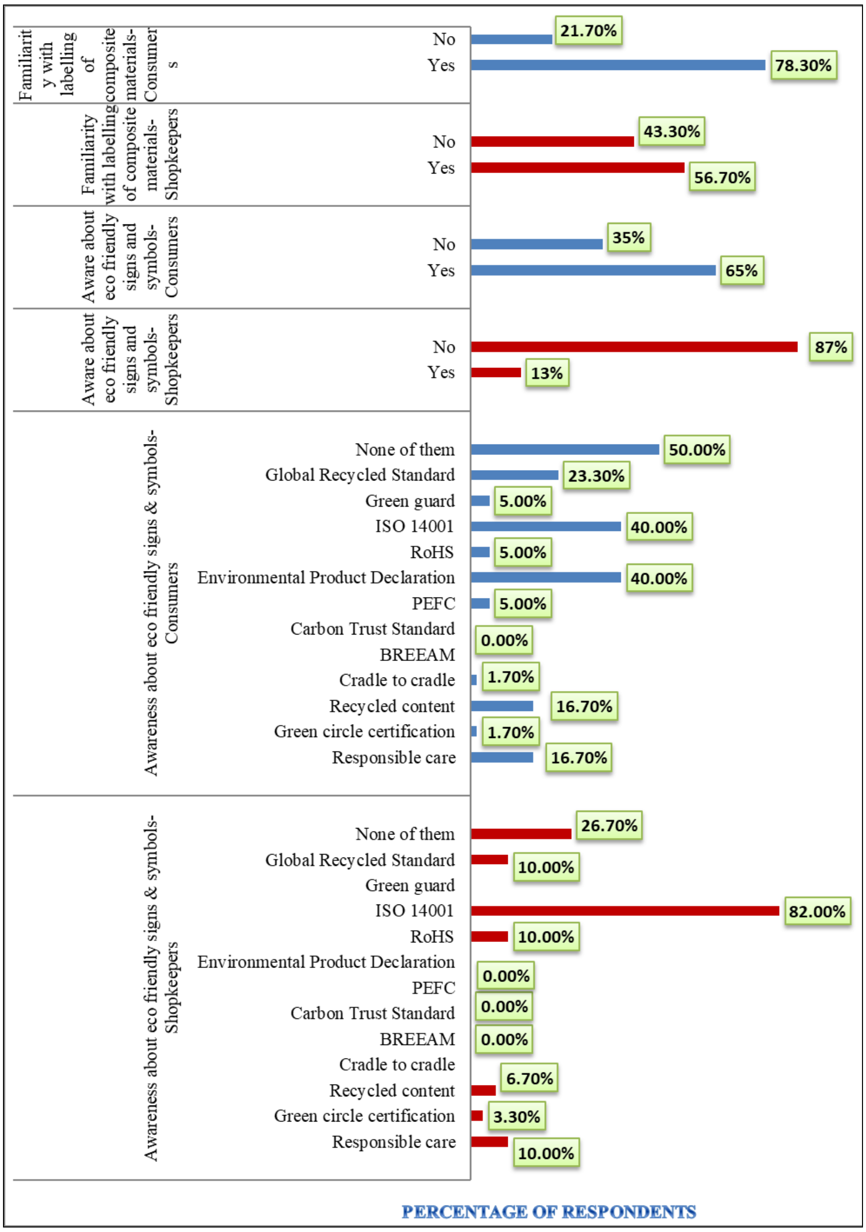
There is a stark contrast in general awareness about eco-friendly signs and symbols. In one case i.e. shopkeepers, only 13% of respondents were aware while in another study group (consumers) there was a jump to 65%.

The Environmental Product Declaration and ISO 14001 symbols were both recognized by 40% of consumers. The Global Recycled Standard and Responsible Care symbols were recognized by consumers and shopkeepers 23.3% & 16.7% and 10% respectively. However, a significant 50% of respondents were not aware of any eco-friendly signs or symbols.

In the case of shopkeepers', it was observed that the ISO 14001 standard had the highest awareness at 82%. This was followed by Responsible Care and RoHS, both at 10%. The Green Circle Certification and Recycled Content were recognized by 3.3% and 6.7% of respondents respectively. However, most other symbols including Cradle to Cradle, BREEAM, Carbon Trust Standard, PEFC, Environmental Product Declaration, and Green Guard had zero recognition.

In conclusion, while there is a significant awareness of certain eco-friendly signs and symbols, there are still a large percentage of respondents who are not familiar with many of these. This highlights the need for increased education and communication about eco-friendly practices and certifications amongst the public and entrepreneurs. Some of the steps to improve these are:

- Organizing educational workshops and webinars on sustainability topics.
- Building partnerships with local eco-friendly businesses. By working together, one can create a network of support for sustainable practices.
- Leveraging the power of social media platforms to spread awareness by sharing informative content, success stories, and practical tips related to sustainable living.
- Developing visually appealing materials like info-graphics, pamphlets, or posters.
- Collaborating with schools and universities to integrate sustainability education into curricula.



Graph 11: Awareness on Labelling of Composite Products

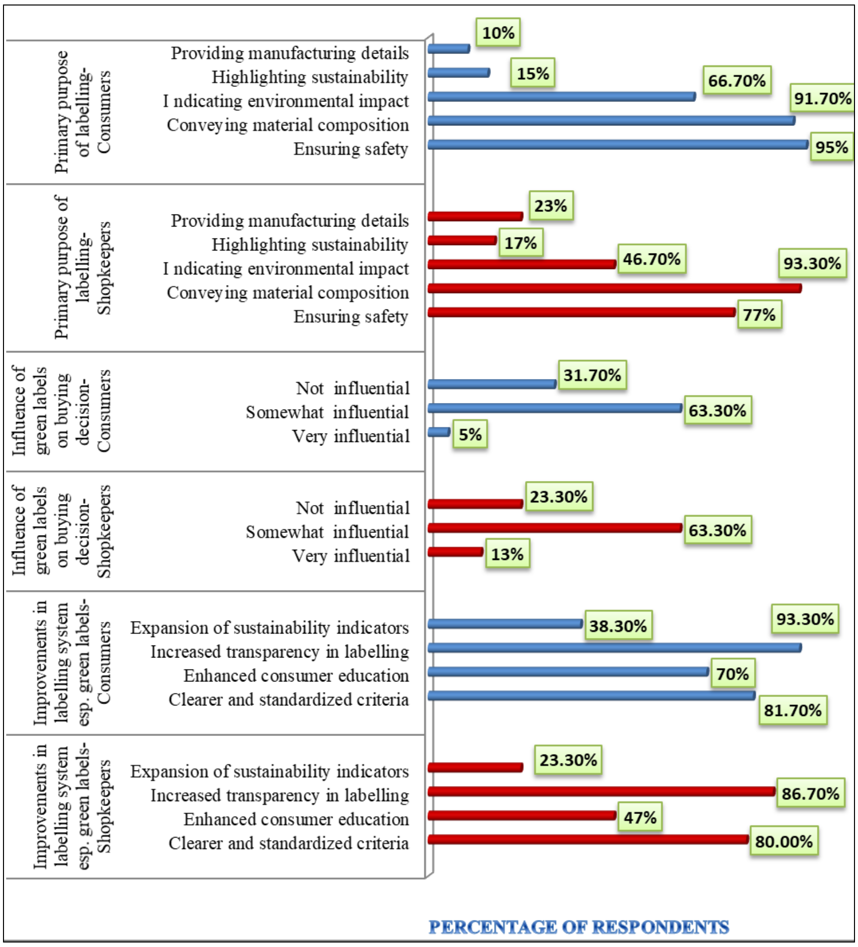
3.7.1 Labels and buying behavior

Information regarding the primary purpose of labelling was sought from both the consumers and the shopkeepers. Conveying material composition was adjudged as the most important purpose of labelling by 91.70% of consumers and 93.30% of shopkeepers. By doing so the shopkeepers can transparently communicate with the consumers About the product composition. Ensuring safety was opted as the next important purpose of labelling by 95% of consumers and 77% of shopkeepers. It is apparent that the consumers were more worried about the product safety than the shopkeepers. While only 46.70% of the consumers thought that the label should also indicate the environmental impact, more than half (66.70%) of the consumers indicated environmental impact as one of the primary purposes of labelling of composite products. It appears that shopkeepers (23%) were more interested to know about manufacturing process or details rather than consumers (10%). Highlighting sustainability in the composite product labelling seem to be the least important purpose of labelling by both the study groups (15% of consumers and 17% of shopkeepers).

The data also in the graph 16 shows the influence of green labels on buying decisions. A small percentage of consumers (5%) and 13% of shopkeepers opined that green labels do influence their buying decision. An equal percentage (63.30%) of both study groups felt that green labels somewhat influenced their buying decision. Consumers (31.70%) do not seem to be influenced by the green labels on the products while choosing different composite products. Shopkeepers on the other hand tend to look for green labels on the products (23.30%) when compared with consumers.

Both the study groups were also asked to suggest various ways through which improvements in labelling systems, especially green labels, can be brought about. Increased transparency in labelling seem to be the most sought after way by both the groups (93.3% of consumers and 86.70% of shopkeepers), followed by clear cut and standardised criteria of labelling systems (81.70% of consumers and 80% of shopkeepers). It was interesting to note that consumers (70%) sought enhanced education, while 47% of the shopkeepers did not feel the need to educate their clientele. Significantly more percentage (38.3%) of the consumers felt that sustainability indicators can be expanded in labelling systems when compared with shopkeepers (23.30%).

In conclusion, the data suggests a strong demand for improvements in the labelling system, especially in terms of clarity, standardization, and transparency. It also highlights the significant influence of green labels on buying decisions and the recognized purposes of labelling. However, there is a need for enhanced consumer education and expansion of sustainability indicators in the labelling system.



Graph 12: Labels and Buying Behavior

3.8 Correlation between demographic profile and consumer awareness of composite products

To answer the following research questions

- Is there a significant relationship between the education level of respondents and their awareness on composite products?
- Is there a significant relationship between the number of years in business related to horticulture and awareness about the related composite products?
- Correlation was computed in SPSS, the findings of which are presented below:

There is a significant positive correlation (r = 0.382) between education qualification and awareness on raw materials and manufacturing process. Individuals with higher education qualifications tend to have better awareness on manufacturing process of horticultural composites. Dhavale *et al*. (2021) in their study revealed that education was significantly and positively associated with awareness level of consumers. Notably, this correlation is strong (r = 0.309) even with usage of horticultural composites as people with higher education tend to use more composites products. It was also interesting to know that there is a significant positive association (r = .275) between the education and the easy availability of the composite products in the market as exposure to market increases as individual becomes more educated.

It implies that more awareness leads to more acceptances and more usage in daily life. This may be due to better exposure to the available market products in and outside their surroundings It is worthwhile to mention that age, occupation annual income and location of residence had no significant correlation with the variables of the study.

Table 2: Analysis of Demographic Profile with Consumer Awareness of Composite Products n = 60

S. No	Variables	Awareness on Horticultural Composites	Usage of Horticultural Composites	Awareness on raw materials and manufacturing process	Awareness on Eco- friendly composites	Awareness on labelling	Availability of composites
1	Age	.149 NS	-.101 NS	.036 NS	.110 NS	.039 NS	-.193 NS
2	Education qualification	.114 NS	.309*	.382**	-.014 NS	.162 NS	.275*
3	Occupation	-.083 NS	.104 NS	.002 NS	.114 NS	-.021 NS	.246 NS
4	Annual income	.093 NS	.062 NS	.191 NS	.001 NS	.204 NS	.120 NS
5	Location of residence	-.042 NS	.011 NS	.118 NS	-.150 NS	.032 NS	.120 NS

**Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
NS –Non-significant

3.9. Correlation between demographic profile and shopkeepers' awareness of composite products

There is a significant positive correlation (r = .423) between number of years in business and usage of the composite products by the shopkeepers. This might be due to the fact that as the shopkeepers spent more time in the business their exposure to different varieties of products increases hence leading to the increase in usage of the same product. It was surprising to note that location of residence and availability of composites showed a significant negative correlation i.e. r = -.425. Shopkeepers residing in semi urban areas found composites more easily accessible as compared to urban and metro residence. This might be due to the following reasons:

1. Semi-urban areas could have local manufacturers or artisans producing composites, leading to better availability within the community.
2. The demand for composites might differ based on the semi urban context. Certain agricultural practices or horticultural activities are more prevalent in those areas, driving the need for such products.
3. Shopkeepers in rural areas might actively seek information about eco-friendly alternatives, leading to better awareness and availability.
4. Rural communities may prioritize eco-friendly practices, making them more receptive to composite products.

It was interesting to know that for shopkeepers, demographic factors like age, education qualification, occupation, annual income and size of business have no significant impact on the awareness level of composites.

In comparison, consumers with higher education qualifications tend to have better awareness on manufacturing process, usage and accessibility of horticultural composites whereas these findings are not significant for shopkeepers. Hence, shopkeepers who have long term of business experience are found to be more aware about composites than the one who are new in the field. Awareness level, usage and availability of composites were found to be independent of their education qualifications for the shopkeepers.

Table 3: Analysis of Demographic Profile with Shopkeepers' Awareness of Composite Products n=30

S. No	Variables	Awareness on Horticultural Composites	Usage of Horticultural Composites	Awareness on raw materials and manufacturing process	Awareness on Eco- friendly composites	Awareness on labelling	Availability of composites
1	Age	-.189 NS	-.218 NS	-.047 NS	.024 NS	.027 NS	-.019 NS
2	Education qualification	.062 NS	.167 NS	-.048 NS	-.175 NS	-.001 NS	.057 NS
3	Occupation	-.171 NS	.079 NS	.095 NS	.068 NS	.049 NS	.174 NS
4	Annual income	-.167 NS	-.163 NS	-.072 NS	-.202 NS	.036 NS	-.102 NS
5	Location of residence	-.164 NS	-.181 NS	-.273 NS	-.048 NS	-.017 NS	-.425*
6	Size of Business	.274 NS	.140 NS	.248 NS	-.115 NS	.304 NS	.222 NS
7	Years of Business	-.062 NS	.423*	-.308 NS	.304 NS	-.319 NS	.142 NS

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).
NS –Non-significant

4. Conclusion

- Among consumers, the awareness levels can be represented as plant supporting sticks (93.30%)> propagation trays (76.7%) > pots/planters (72%). Among shopkeepers the awareness of the five product categories was propagation tray (90%) > greenhouse coverings (58%) > mulching films (43.3%) with agriculture related events/exhibitions emerged as the primary source of information for both consumers (98.3%) and shopkeepers (93.3%) whereas traditional advertising is having minimal impact on consumer awareness.
- Interesting disparities between consumers and shopkeepers regarding the usage of composite products in horticulture were seen. While propagation trays remain underutilized by consumers (3%), shopkeepers (40%) actively employ them in nurseries.

Pots and planters find favour among both groups, with 70% of consumers and 90% of shopkeepers utilizing them for plant propagation. However, mulching film usage remains low (10% consumers, 20% shopkeepers). Greenhouse coverings see minimal adoption (3.30% consumers, 27% shopkeepers).

- With regards to the availability of composites, it was found that pots/planters were readily available, others like propagation trays, mulching films, and greenhouse coverings were not easily available according to both consumers and shopkeepers. Pots/planters and plant supporting sticks saw maximum consumption.
- The most preferred sources for buying composite products, as per consumers' were local exhibitions (96.7%), followed by agricultural cooperatives (46.7%) and specialized agro textile stores (36.7%). On the other hand, shopkeepers preferred local exhibitions (70%), local agricultural supply stores (40%), and specialized agro textile stores.
- Both consumers and shopkeepers have a low level of understanding about the manufacturing process of composite products for gardening, while shopkeepers had slightly more knowledge on the manufacturing process.
- A significant majority of both groups (78% of consumers and 58.3% of shopkeepers) claim to have knowledge about eco-friendly composites but interestingly more than half (63.3%) of the shopkeepers had used these products in the past, while a majority (78.9%) of the consumers had not. Eco- friendly composites are still difficult to purchase easily in the market. The survey revealed that a majority (87%) of the shopkeepers opined that these products were easily available, while 85% of the consumers did not, with the most significant challenge faced by both groups as the limited availability in local stores (75% and 66.7% of the shopkeepers and consumers respectively).
- There was a stark contrast in general awareness about eco-friendly signs and symbols. In one case i.e. shopkeepers, only 13% of respondents were aware while in another study group (consumers) there was a jump to 65% which may be due to their high education level and also exposure to several varieties of markets.
- The study concluded with the most interesting finding i.e. there is a significant positive correlation between education qualification and awareness of manufacturing process, usage and availability of composites in case of consumers. Individuals with higher education qualifications tend to have better awareness on manufacturing process, usage and accessibility of horticultural composites whereas these findings are not significant for shopkeepers. Hence, shopkeepers who have long term of business experience are found to be more aware about composites than the one who are new in the field. However, there is a significant need for enhancing the consumers' education regarding the area of composites to benefit both the environment as well as the consumers.

In conclusion, the study of textile composites is a comprehensive exploration of a material class that offers immense potential for diverse applications. The continuous evolution in the types of raw materials used and the manufacturing methods employed promises further advancements in this field. The future of textile composites is bright, with endless possibilities for innovation and application.

5. References

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