Njavara, A Medicinal Rice: An Exploration of the Changing Production and Consumption System

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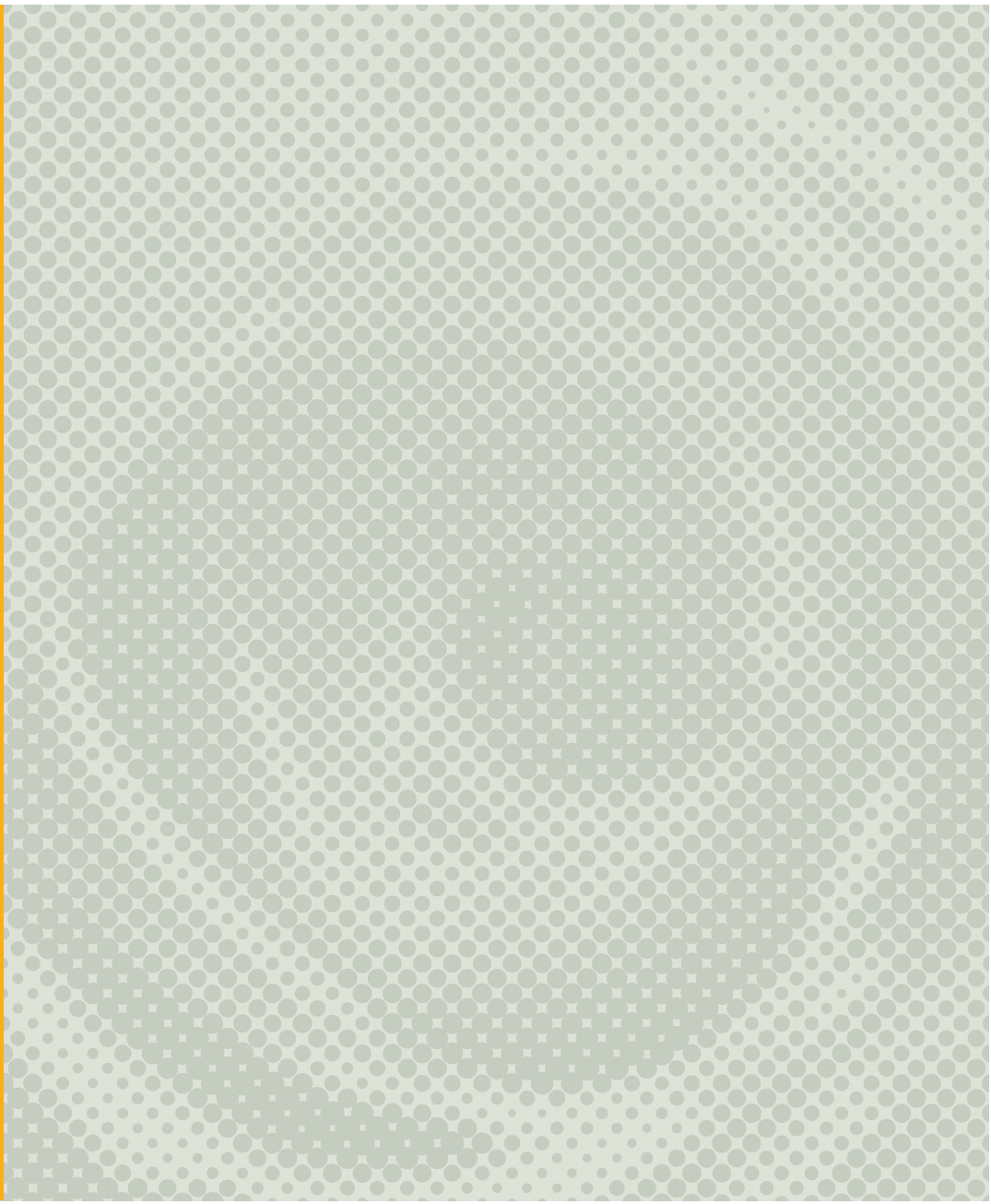

Abstract

Njavara is an ancient rice variety that has been cultivated in Kerala for its medicinal properties for over 2500 years. Over the last few decades, the Njavara rice chain has changed as new actors have entered the system, and there has been a change in consumption patterns. An understanding of these changes is essential in order to properly assess the value of this rice in economic, cultural, and biological terms. The various actors in the Njavara chain were interviewed and asked about the current system, how it has changed, and why it has changed from the traditional Njavara system. Rich picturing and analysis of the interviews using coding was used to answer the questions related to the changing Njavara chain. The results of this work show that Njavara production and consumption has changed in order to adapt to changing socio-political conditions. Njavara is now more easily available and widely used, though there are concerns regarding the authenticity of the rice on the market. But there is a declining trend of Njavara cultivation, which entails the loss of biological and cultural diversity associated with this unique rice. Preserving Njavara is valuable for the medicinal, economic, and economic value it provides for the people associated with this rice. An understanding of how this rice system has changed provides valuable lessons on for conservation that can also be applied to other crops elsewhere.

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List of acronyms

GI - Geographic Indication

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2. Introduction

The natural environment provides the background for many cultural activities and beliefs and the resulting landscapes are a reflection of human activities that have occurred over time. As a result, there exists a feedback mechanism by which cultural or environmental changes affect each other [1]. The value of biological and cultural diversity in creating resilient systems that can adapt to change has been recognized [2]. The links between biological and cultural diversity are also seen in previous studies that have shown that traditional knowledge, an aspect of cultural diversity, plays an important role in the preservation of biodiversity [3, 4]. But very often biological and cultural diversity are understood as distinct, and the fact that they interact with each other in order to respond to change is easily overlooked. Communities adapt to changes around them using a process of cultural exchange, and the result may be a change in traditions [5]. Maintaining cultural and biological diversity can help communities adapt to changes around them by providing a rich pool of resources to tap in case of change and hardship. In order to have a thorough understanding of the challenges of conservation, it is necessary to understand the changes in social, political, and economic conditions that are driving the changes in biological and cultural diversity.

Njavara, sometimes called Navara, is a medicinal rice variety that has been cultivated for over 2500 years in the south Indian state of Kerala [6]. Studies have shown that Njavara is a distinct variety of rice with some genetic diversity [7- 9]. The genetic purity of this rice has been maintained by farmers due to the asynchronous flowering patterns of this short duration variety with other commonly cultivated landraces, thus preventing cross-pollination [10]. Four distinct morphotypes of Njavara were described by Sreejayan et al. based on plant height and glume colour: short black, short yellow, long yellow, and intermediate yellow found predominantly in Wayanad, Palakkad, Kuttanad, and northern Kerala respectively [10]. Njavara is unique because it is both a medicinal plant and a grain. Any changes affecting rice production in Kerala will also affect Njavara production. Despite the importance of Njavara in medicine, it is affected by the same challenges faced by agriculture in Kerala and all over the world.

Traditional medicinal uses for the rice have been mentioned in ancient Ayurvedic[1] texts such as Vagabatta's *Ashtanga Hrudayam* written between 400 and 500 AD [11]. Today, the most well known of these Ayurvedic therapies is Njavara *kizhi*[2] for treating paralysis and certain neurological disorders [12]. Another major use for this rice that has been mentioned in literature is consumption of Njavara in the form of a medicinal porridge, *karkidaka kanji*[3]*,* during the monsoon season in order to increase the body's immunity [13]. The lower starch content of the rice has also made it popular among diabetics for regular consumption [14]. New research has shown a variety of possible uses for this rice. Njavara has been found to have anti-inflammatory and rare flavonolignans, which increase its potential uses in medicinal applications [13]. It was also found to be a source of anti-oxidants and may have potential anti-cancer activity [15]. Njavara's starch and thermal properties have been studied in depth as well. The slimy nature of the rice, when cooked, combined with unique pasting and thermal properties may explain its role in transferring bioactive compounds to the body during treatments such as Njavara *kizhi* [12]. The starch is stable at high temperatures, making it suitable for potential future food industry applications [16].

Conserving Njavara and the cultural traditions associated with this rice is valuable for a number of reasons. From a biodiversity perspective, this rice provides potentially useful genetic material related to its medicinal properties, as well as its pest and disease resistance qualities, despite its low yield [9, 12]. Njavara is also of great value for its medicinal uses today as well as for any potential future medicinal applications for this rice. As will be seen in this paper, cultivation and selling of Njavara is an important economic activity for individuals involved in the Njavara rice chain. The cultivation and use of Njavara contains an important cultural component. The rice has played an important role in Ayurveda, the traditional system of medicine, which also has a significant spiritual component for the local people. Given the importance of this rice for present and future medicinal uses, as well as its role in the tradition and culture of the people of Kerala, these

[1] Ayurveda is a traditional Indian system of medicine.
[2] Njavara kizhi is a specific Ayurvedic treatment where a poultice is made using Njavara, milk, and herbs and massaged over the entire body for treatment of conditions such as paralysis and arthritis.
[3] Karkidaka kanji is a medicinal porridge in which Njavara is the main ingredient. The porridge is made with Njavara and other herbs and consumed during the monsoon season to increase the body's immunity against diseases.

changes in the Njavara system help demonstrate how this rice can be conserved. In addition to the conservation imperative described above, this study provides abundant lessons that can be applied to myriad other crops around the world. The changes occurring in the Njavara system are not unique to this Kerala or to this rice alone. While the details of the Njavara production and consumption system (Njavara chain) will differ from other crops in other regions, the overall theme of a landrace undergoing significant changes in light of social and economic shifts is a familiar situation. This study of the system and the changes that are occurring will lend perspective to parallel research endeavors elsewhere.

In this paper, I describe the current situation of Njavara in Kerala and compare it to the traditional system of this rice. The focus of the paper is on the changes that have occurred over the past few decades. I analyze the factors that have driven these changes in the system with the goal of understanding the challenges faced by Njavara conservation in modern day Kerala. The goal of this study is to focus on three specific aspects of the changing Njavara system. The first seeks to understand the current Njavara rice chain in Kerala by focusing on the rice, its cultivation, and its uses. The second is to understand what changes have occurred in the Njavara chain when compared to the traditional system of Njavara production and consumption. The third focus explores why these changes are occurring in the Njavara system.

3. Methods

Field research was carried out between December 2011 and February 2012 in the south Indian state of Kerala. The study area was limited to the state of Kerala because cultivation of Njavara is restricted to this area and it is most popularly used within the state. Kerala is located along the extreme south west coast of the Indian peninsula (Fig. 1). The state is surrounded by the Arabian Sea on the west and the Western Ghats mountain range on the east. Kerala is located between latitudes 8°18’ and 12°48’ and longitudes 74°52’ and 72°22’. From the east to the west the state can be divided into three regions based on the physical characteristics: the hills and valleys, the plains, and coastal lands [17]. The climate

in Kerala can be characterized as humid equatorial tropic according to the Köppen climate classification [18].

Twenty-five interviews were carried out in four different districts of Kerala in order to understand the Njavara system in the state of Kerala. The four districts were Thiruvananthapuram, Kollam, Palakkad, and Wayanad. Figure 1 shows a map of Kerala showing the districts of data collection. Thiruvananthapuram and Kollam are not traditional areas of Njavara cultivation, while Palakkad and Wayanad have traditionally been and continue to be two of the major Njavara producing districts. Thiruvananthapuram is an important center for Ayurvedic medicine with a large number of hospitals and physicians. Kollam is an area where today the rice is being consumed for personal consumption even though Njavara has not been traditionally cultivated there.

Figure 1: Map of Kerala showing the districts where interviews were carried out.

The selected informants included ten farmers, four Ayurvedic physicians, three researchers, six sellers, and six consumers. The distribution of interviewed individuals in the various districts can be seen in Table 1. Some individuals fell into more than one of these categories. Each of these categories are defined as follows:

- Farmers are those people involved in Njavara cultivation. Although they may be involved in other parts of the rice chain as well, they were identified as farmers if they produced any Njavara. Some of these producers are occasional producers, not cultivating Njavara every year. Included in the study were farmers who cultivated Geographic Indication certified Njavara, farmers participating in a guaranteed buy-back program, farmers involved in direct sales and those producing for personal consumption.
- Ayurvedic physicians interviewed for this study included individuals from different part of the state who used Njavara for treatments in their practice. These included doctors at both private and public hospitals. None of them cultivated Njavara for their own use and depended on local producers for their rice.
- Sellers include both wholesalers as well as retailers involved in selling Njavara to individuals as well as to larger consumers like hospitals and clinics. This study included both wholesalers as well as retailers. Some of the sellers interviewed for this study were also farmers who sold their Njavara directly to the consumers.
- Individual consumers included a variety of people who have experience using Njavara either in Ayurvedic treatment or in the form of other traditional remedies. Consumers in different parts of the state were chosen in order to understand any variation in use depending on location of the respondents.
- Researchers have been involved in studying various aspects of Njavara. They were interviewed regarding their work on Njavara as well as their understanding of the Njavara system.

Table 1: Distribution and categorization of interviewees across the four districts

District	Farmers	Ayurvedic physicians	Sellers	Researchers	Consumers
Thiruvananthapuram	1	2	2	1	2
Kollam	1	-	-	1	1
Palakkad	4	1	2	-	2
Wayanad	4	1	2	1	1

The type of sampling used for this study can be described as targeted snowball sampling [19]. Targeted sampling is the process of selecting those individuals who are most relevant for the study. In this case the goal was to identify individuals who were involved in the Njavara chain. Once key actors in the Njavara production and consumption chain were identified, snowball sampling was used to identify other informants. Initially, a farmer association specialized in Njavara cultivation was identified and became the starting point for data collection. This farmer association was identified through Internet searches for Njavara production. Subsequently, researchers in the field of Njavara were identified. These researchers provided information about other individuals who might be useful for the study. Thereafter all interviewees were asked for suggestions for other individuals that were involved with Njavara. During the entire process interviews and informal discussions were held with individual consumers using Njavara.

The data collection process consisted of a combination of informal, unstructured, and semi-structured interviews [19, 20]. Informal interviews were used for the consumers to have an understanding of the variety of uses and knowledge related to Njavara. These people were asked about their familiarity with the rice and how they used the rice.

Semi-structured interviews were held with the rice producers, Ayurvedic physicians, and Njavara sellers (See Appendix 1 for interview guides used in the semi-structured interviews). All farmers were asked the same questions. The four main aspects that were discussed in the farmer interviews were: i) their understanding of what Njavara is, ii) their reasons for growing Njavara, iii) details about their Njavara production, and iv) the process

of marketing and selling Njavara. The physicians were asked about: i) their understanding of Njavara, ii) their uses for the rice, and iii) difficulties they see in Njavara use. The questions to the sellers focused on: i) their understanding of Njavara, and ii) marketing and sales of the rice. All other individuals responded to open interviews that were modified according to their role in the Njavara chain. The objective was to gain an understanding of their role in the chain as well as their interactions with other actors involved in Njavara.

The interviews consisted of a combination of in-person and three phone interviews. The phone interviews were necessary in a few cases where in-person interviews could not be carried out due to practical difficulties and distance. Most of the interviews were carried out in Malayalam, the local language, but a few were also held in English when the interviewee initiated it. The Malayalam interviews were subsequently translated into English. The interviews were recorded by taking notes during the interview process, except in the case of informal interviews where summaries of the conversations were made soon after the discussions ended.

Data analysis commenced during the data collection stage. The first step of the analysis was to create a rich picture of the current situation. The rich picture, as described by Checkland, provides a medium for presenting the complexity of the current situation [21]. It presents the various actors and their interactions with each other as well as their environment. Further analysis followed the three-step process of annotations, memos, and coding as described by Newing [22]. Annotations consisted of comments made on the notes regarding following up with informants for clarification or any links to literature. Memos were added to notes to highlight the main ideas emerging from individual interviews. Coding was used to identify the main topics emerging during the research. The coding process and the categorization was the first step in the organization of data. The hierarchical system of codes provided the basic framework and possible ways for data interpretation [22].

Through coding, emerging patterns of themes could be identified, which were then summarized based on all the data that was available related to each theme. Each theme was summarized and raw data cross-checked with the analysis.

4. Results and Discussion

This section presents the results of the study and analyses them in relation to the research questions. This section is divided into three subsections, each addressing one of the three research questions. The first section is a description of the current Njavara rice chain as understood by the interviewees. The second section compares the traditional Njavara system to today's production and consumption in order to identify the changes that have occurred. The third section explores why these changes are occurring within the Njavara system.

4.1. The Njavara System: The Modern Perspective

The current situation describes the rice and the production and consumption chain as explained by the interviewees during this study. The rich picture presents the various actors involved with this rice and how they interact with each other and their environment. A description of the current situation of Njavara includes results from the interviews that present the characteristics of Njavara, uses for the rice, and cultivation practices.

4.1.1 A Rich Picture

Figure 2 is a rich picture of the present Njavara production and consumption system.

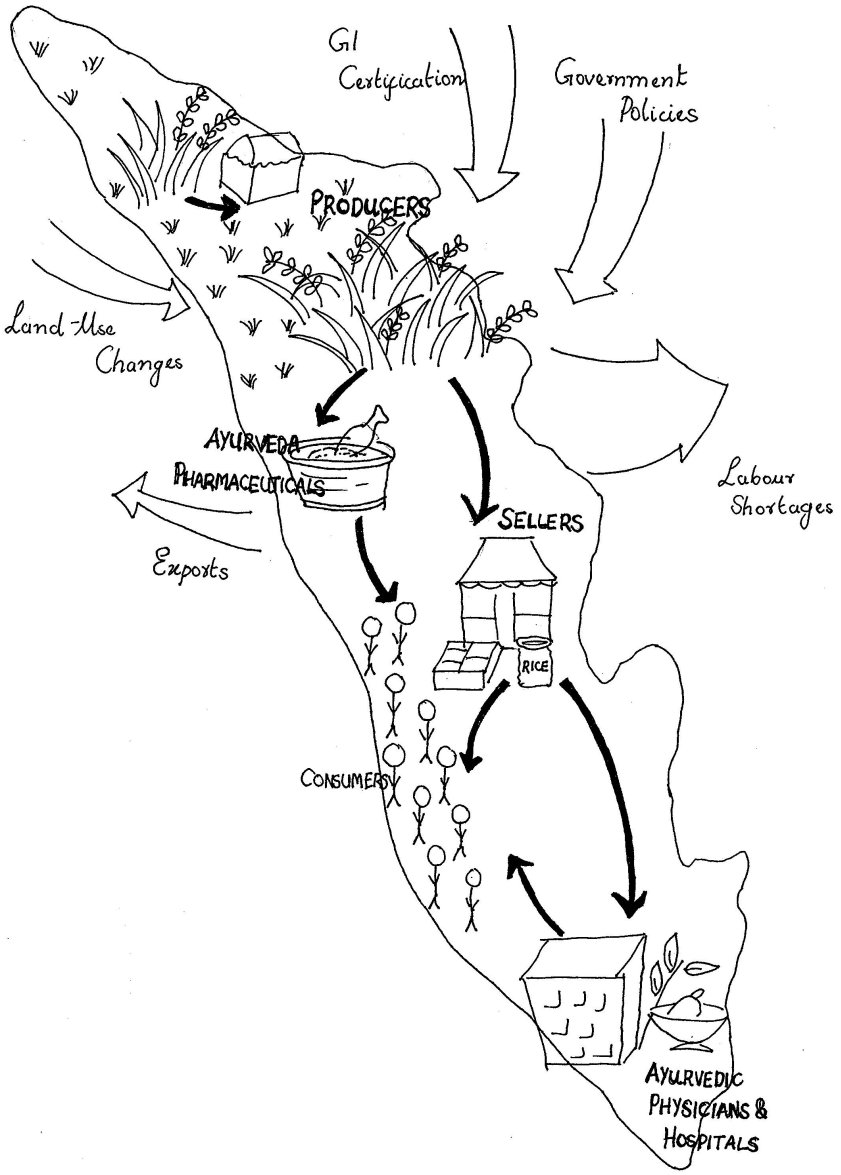


Figure 2: A Rich Picture of the current Njavara system

Today's Njavara system is characterized by a variety of actors involved in the production, marketing and selling, and consumption of the rice. From the study, two types of producers were identified: the small scale farmers using traditional techniques and producing Njavara for self or local consumption, and the more intensive Njavara farmers, producing larger quantities of the rice for the market. There was also variety among the sellers. While some were farmers, selling their own product, others were herb shops and pharmacies selling a variety of medicinal products including Njavara. The main consumers of the rice are the Ayurvedic physicians using the rice for their medicinal preparations and individuals buying the rice for personal consumption. Although nationally known Ayurvedic pharmaceutical companies are an important part of today's Njavara chain, they were not interviewed during this study because of challenges getting interviews with appropriate company representatives and refusal to share much information regarding their raw materials. The main role of these companies in this chain is the production and sales of pre-packaged *karkidaka kanji* kits during the monsoon season. The gap in information from the perspective of these pharmaceutical companies is one of the limitations of this study.

The boundary of the Njavara system is represented with the borders of Kerala state. Various factors external to the system also influence the production and consumption of the rice. The main factors shown in the rich picture are government policies regarding rice production, certification of Njavara, agricultural labour shortages, and land use changes resulting in declining rice production area.

4.1.2. Characteristics of Njavara

The two main characteristics that interviewees used to describe Njavara were the physical appearance of the husked rice, its unique qualities, and its short growth duration. While farmers described the rice using its maturation time, sellers and individual consumers used its physical characteristics and unique qualities to describe the rice. Farmers pointed out that Njavara was a short duration rice of approximately sixty days. This characteristic, in addition to its medicinal qualities and other agronomic characteristics, was what the farmers used to describe the rice. Sellers said Njavara was easy to identify based on appearance. They showed samples of the rice to show that it was distinct from other

commonly consumed varieties of rice. Individual consumers interviewed said that they were unable to identify the rice and only knew the physical characteristics of the rice as it appeared in the *karkidaka kanji* kits.

Physicians used multiple qualities to describe the rice. Ayurvedic physicians felt that the rice could be identified by its very specific physical appearance. One doctor described the rice as similar to raw *Chamba*, a common staple variety. Doctors also described its unique qualities. One described the rice as cooling very fast after cooking as a result of the high protein content. He also described the unique color of the rice and the *ghee*-like texture of cooked Njavara. One physician said that identification of the rice comes with experience and he mentioned a unique smell when the rice is broken. Doctors also described the short maturation time of Njavara as mentioned in the Ayurvedic texts.

Researchers pointed out that maturation times are not a reliable characteristic for identification because the growing time for Njavara is different depending on the growing conditions in different areas. One pointed out that maturation time increases as you move further north in the state, and in the district of Wayanad, the rice can take up to 180 days to mature. Variability in physical appearance was also seen in the samples from various locations collected during this study (Figure 3). But this variation within Njavara did not seem clear to all interviewees. Only researchers seemed to be aware of the variations that exist within Njavara, while all other interviewees were only familiar with the type of Njavara available in their local area. Variation in the rice was also linked to a discussion about the possibility of inauthentic Njavara being sold as the real product. Farmers and physicians felt that there was adulteration in the market as other rice was being passed off as Njavara.

Figure 3: Njavara samples collected during the study compared to a common staple variety Palakkad Matta. 1: Unhusked Njavara sample from Wayanad, 2: Husked Njavara sample from Wayanad, 3: Husked Njavara sample from Palakkad, 4: Husked Njavara sample from Kollam, 5: Husked Njavara sample from Thiruvananthapuram, 6. Husked Palakkad Matta rice (Source: http://www.indiamart.com/duraisamyricemill/south-indian-rice.html).

4.1.3. Uses for Njavara

When the respondents were asked about the uses for Njavara, 22 (n= 25) of them said that the main use for the rice was for its medicinal properties. The various uses mentioned by the interviewees and the number of people who mentioned that particular use can be seen in the table below.

Table 2: Various uses for Njavara as described by interview respondents.

Use for Njavara	Number of respondents (n=25)
Njavara *kizhi*	14
Karkidaka kanji	10
Regular consumption	4
Baby food	2
Consumed by diabetics	1
Health drinks	1
Other uses	1

Physicians had the most in-depth knowledge of the variety of uses for Njavara. In Thiruvananthapuram and Kollam, most respondents talked about the two most common uses of Njavara in *kizhi* and in *karkidaka kanji.* More uses for Njavara were mentioned by interviewees in areas of traditional Njavara use and cultivation such as the districts of Palakkad and Wayanad. Regular consumption of the rice was associated with aristocratic families because it is much more expensive than common staple varieties. The only exception was one farmer who grew Njavara for self-consumption. Other uses for the rice included using the bran and root for medicinal preparations.

4.1.4. Njavara Cultivation

Farmers were asked about their experiences cultivating Njavara, and there was no consensus among farmers about the difficulty of growing this rice. Farmers interviewed for this study used a variety of techniques for their Njavara cultivation, ranging from traditional techniques to those using modern inputs such as pesticides and fertilizers to cultivate their rice. While six of these farmers expressed difficulty with Njavara cultivation, two felt it was a relatively easy crop to cultivate. This divide among farmers seemed to depend on the cultivation techniques they used. The two farmers who had little difficulty with the crop used more modern agricultural techniques such as pesticides and fertilizers. The felt the rice had a good yield with low pest and disease incidence requiring very little pesticide and fertilizer compared to other rice varieties. These individuals also found the labour requirements of Njavara to be moderate when compared to other conventional rice varieties.

The farmers who said that Njavara was a difficult crop to cultivate used traditional techniques. In these cases the rice is sown using direct sowing methods. Green manure and cow dung are used for fertilizing. Weeding and harvesting is done by hand. In some cases pest management is also done by hand using nets, while in other cases traditional pesticide preparations are applied. These farmers found Njavara to have low yields,

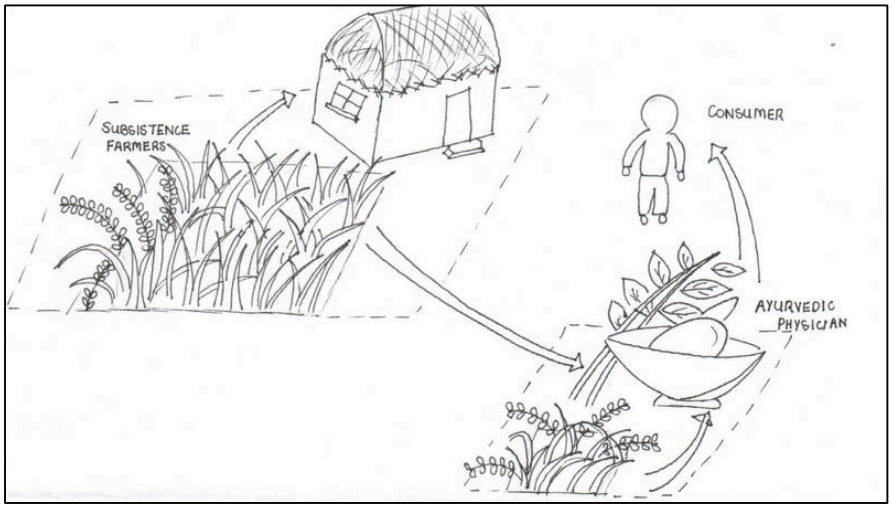
requiring high inputs and producing low quality straw. The growers using traditional techniques also found that Njavara cultivation had high labour requirements.

Eight of the farmers (n=10) interviewed for this study are traditional Njavara farmers and were the first to cultivate this rice on their farms. These farmers received seed in multiple ways. Two farmers were given seed by a local non-profit organization trying to preserve traditional rice varieties, four of them looked for pure Njavara seed and obtained it from traditional growers, one obtained seed from a local temple, and the other got it from a research institution. Access to good quality pure Njavara seed was mentioned by all farmers as a challenge for Njavara cultivation.

Two farmers (n=10) are traditional Njavara growers and Njavara has been grown on their fields by previous generations as well. These farmers grew Njavara in small quantities in addition to other rice on their fields. They said they followed traditional growing techniques and cultivated it for the medicinal properties. Although it had low yields compared to other rice, they said it was not significant because Njavara was only a small part of their rice production.

4.2. The Njavara System: How has it changed

The changes that have occurred in the Njavara system are important to study in order to gain a better understanding of how this system has been responding to changes insocial, economic and political conditions. Figure 4 provides a comparison of how the situation has changed in terms of the actors and their interactions with each other within the Njavara chain. The changes described in this section are those described by the interviewees as well as what can be found in literature describing traditional Njavara systems. The changes have been categorized as: changes in the rice and its cultivation, changing actors and markets, and changing uses and knowledge. It is important to note that these changes did not occur in isolation; they influence and drive each other. Together they represent the differences between the traditional system of Njavara production and consumption and the Njavara system in modern Kerala.



Traditional Njavara rice chain

Modern Njavara rice chain

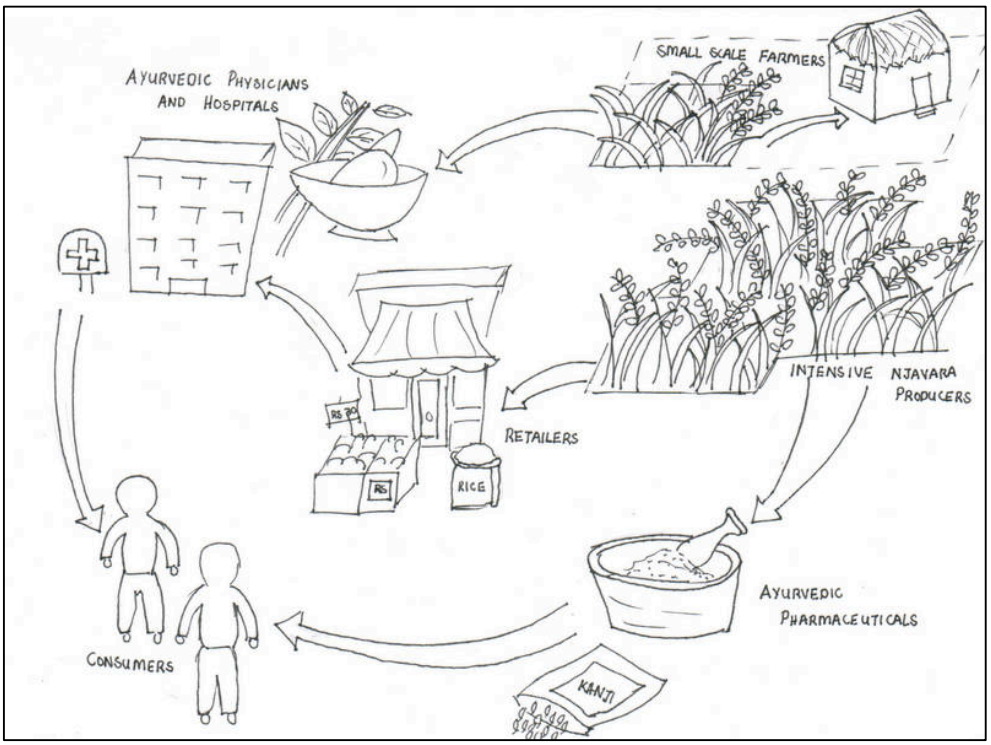


Figure 4: Comparison of traditional and modern Njavara rice chains showing changes in actors and their interactions with each other.

4.2.1. Changes in the rice and its cultivation

Some of the main changes occurring in Njavara have been changes in the rice itself. As reported by interviewees, the rice has seen an increase in the number of days to maturation from what was originally mentioned in Ayurvedic texts. Research shows that there are four different genetic morphotypes of Kerala that are geographically separated [10]. Traditionally, farmers only used their own seed and did not cultivate using 'unknown' seed from other farmers [10]. Most of the farmers interviewed for this study obtained seed from areas outside of their districts of cultivation. Njavara has also been introduced to districts like Thiruvananthapuram and Kollam where there has traditionally been no cultivation of Njavara. Research also shows that one of the morphotypes of Njavara that is now found in northern Kerala may have undergone gene introgression in recent years [10].

There also seems to be a change in the role of Njavara in farmers' fields. Traditionally, Njavara was grown along with other rice varieties in a small area of the field, and usually it was cultivated only for local consumption. Only three of the farmers interviewed were growing Njavara in addition to other varieties of rice. Only one was growing the rice for personal consumption. Most of the farmers interviewed were cultivating larger areas of Njavara intended for sale for medicinal use. At the same time there has also been a reduction in the cultivated area of Njavara. One report indicates that Njavara cultivation is now limited to 50 hectares in the state of Kerala [23]. An interviewee reported that up to 2000 hectares of Njavara had been cultivated a century ago. Cultivation techniques have also changed. Njavara was once cultivated only using traditional organic techniques but today is sometimes cultivated using more modern inputs like chemical fertilizers and pesticides. While use of these modern techniques seemed to increase yields, profits for farmers depended heavily on other factors such as their ability to sell the rice.

4.2.2. Changing roles of actors and the market

Traditionally Ayurvedic practice was a family activity where practitioners provided medical treatment as a service to others in their community. In this system, the practitioners also grew their own medicinal plants and sometimes bought from neighboring farms. But with the changes occurring in society and within Ayurvedic practice, physicians started buying their medicinal products from retailers instead of producing it themselves [24]. These changes have also affected the Njavara system as middlemen (retailers) were introduced into this chain that traditionally featured direct sales.

The increasing popularity of Ayurveda has added another important stakeholder to the traditional Njavara chain in the form of the Ayurvedic pharmaceutical companies. Nowadays, Njavara is marketed by sellers and pharmaceutical companies in the form of *karkidika kanji* kits (Fig. 5). Although the *kanji* was a traditional use for the rice, the introduction of these pre-packaged products are a new addition to the market and one interviewee estimated this to be a Rs. 6-7 crore (US $1- $1.2 million) industry anually. There has also been an expansion of the Njavara market. It is now available to consumers in parts of the state that have not traditionally produced Njavara. Although there seems to be a bigger market for Njavara, some of the farmers interviewed during this study also mentioned that selling the rice was a challenge. Interviewees said that some farmers had to sell their Njavara as ordinary rice at lower prices because they could not otherwise sell their product.

Some producers of the rice have organic and Geographical Indication certifications for their product, thus increasing the export potential of this rice that was traditionally limited to production and use in certain parts of Kerala.

Figure 5: Contents of pre-packaged karkidaka kanji kits showing Njavara and other medicinal herbs (Source: http://seemycollections.blogspot.com/2010/08/karkidaka-kanji.html)

4.2.3. Changing uses and traditional knowledge

This study shows that there seems to be a decreasing trend in the variety of applications for Njavara. Results from the interviews highlight that Njavara *kizhi* and *karkidaka kanji* are the most well known uses for the rice. Respondents in the traditional Njavara growing and using areas reported many more uses for the rice. The variety of uses for Njavara have been noted in traditional Ayurvedic texts like Vagabatta's *Ashtanga Hrudayam* written between 400 and 500 AD [11]. As noted by Sharma, uses for Njavara included treatment of ailments ranging from polio and snakebites to stomach ulcers and skin diseases [25]. The oil from Njavara has also been traditionally used for the treatment of pain [26].

As the rice has become more widespread, there has been a change in the traditional knowledge associated with using the rice. The popularity of certain products like the *karkidaka kanji* kits seem to have overshadowed Njavara's use in more traditional applications for maintaining health. Although the rice has become more widely available, only certain aspects of use related traditional knowledge seems to have become widespread. Seven interviewees said that awareness regarding the rice was low and that most people were not aware of the many medicinal properties of this rice. Even among the

individual consumers interviewed for this study, only two (n=6) were aware of uses other than the *kanji*.

4.3. The Njavara System: Why has it changed

An analysis of the current Njavara system shows that there have been major changes from the traditional system. Each of the actors of the system has undergone a change from their traditional role. In the process, the rice itself has changed from a medicinal plant cultivated in small quantities by subsistence farmers to a widely available Ayurvedic product. These changes have come with both positive and negative consequences for those involved and for Njavara itself. The changes that have occurred in the Njavara system have been driven by social, political and economic factors both within and external to the system. It is difficult to distinguish these factors as being internal or external to the system, but here the internal drivers are presented as those factors which directly involve the actors within the Njavara system. These are changes that are unique to the Njavara system and are related to changing cultivation and use practices. The external factors are those drivers that have been driving changes in different aspects of Kerala agriculture including the Njavara system. These changes affect agriculture in general but in this case have also changed the way in which Njavara is being produced and consumed. In the following section I discuss why the Njavara system is changing and what this may mean for conservation of the rice.

4.3.1. Internal drivers of change

One of the biggest drivers of change in the system has been the entry of the Ayurvedic pharmaceutical companies and their role in changing consumer awareness and consumption of Njavara. The traditional system of Njavara cultivation revolved around small-scale farmers producing this medicinal rice for local use. The cultivation of Njavara was restricted to certain parts of Kerala, and it was mainly used in these same areas by both Ayurvedic physicians and people who used this rice for maintaining their own health. During this period, farmers used their own seed for their crop and thus maintained this medicinal rice variety for centuries.

Today's situation is very different. There are new actors that have entered the Njavara chain and there has been an increase in the availability of this rice. Today, consumers all over the state have access to this medicinal rice for Ayurvedic treatments as well as for other applications such as *karkidaka kanji*. The rice is now cultivated in many different parts of the state including those that have not been traditionally known for Njavara cultivation. But with the expansion of the area and quantity of rice being produced for the market, there are questions of authenticity of the rice available to consumers. Findings about other rice being sold as Njavara were published in a national newspaper [23, 27].

What was once a small-scale production of medicinal rice for local consumption has today become a major economic activity for those involved in the production and sales of this rice. Today, approximately 300 tons of this rice is used for Ayurvedic treatments in the state [28]. Most of the Njavara used by these companies is in the form of pre-packaged *karkidaka kanji* kits. The increasing demand for this rice has led to an intensification of Njavara production. Although none of the farmers interviewed for this study cultivated rice for these companies, physicians and sellers reported that Ayurvedic pharmaceuticals have encouraged new farmers to take up Njavara cultivation in order to produce rice for them by assuring markets for their product.

Ayurveda is gaining popularity as a complement to modern medicine in contemporary Kerala society [29]. This means that the demand for medicinal plants like Njavara is likely to rise as these products become available to consumers in all parts of the state and even the world due to the influence of Ayurvedic pharmaceutical companies. This situation provides an opportunity for Njavara farmers to use this medicinal plant cultivation as an economically viable agricultural activity as has been noted with other plants in different parts of the world [30, 31]. The potential of medicinal rice diversity, especially Njavara, for the preservation of rural livelihoods has been studied by Kumary [6]. Although quality control is easier to manage in larger scale systems such as these, there needs to be a system in place to ensure that consumers are in fact paying for authentic Njavara.

4.3.2. External drivers of change

Most of the changes that are seen in today's Njavara system are the result of external factors such as changing socio-political conditions. Njavara is in a unique position because of its role as a medicinal plant aswell as a staple grain, rice. Therefore any changes that affect agriculture in Kerala also impact Njavara cultivation. Kerala is home to a variety of medicinal rices, which are local landraces. These include Chennellu, Kunjinellu, Njavara, and Erumakkari. But many others that were previously cultivated are no longer found in Kerala [6]. The arrival of high-yielding varieties and cultivation of other cash crops are some of the major reasons for the reduction in cultivation of landraces [9, 32]. A study by Kumar shows that a majority of the landraces in Kerala has disappeared [29]. Although he does not quote exact numbers on the loss of diversity, the overall genetic diversity of rice farms has decreased in the state [33]. The role of politics and government policies in the decline of rice production in Kerala has been studied by Narayan [34]. The declining rice production has impacted Njavara as well as trends show a decline in area of Njavara cultivation [28]. The main factors driving these changes, as reported by interviewees, are changing land use practices, declining labour availability, and government policies.

1. Changing land use practices - All over the state, respondents explained that rice paddies are being converted to plots for residential construction or for cultivation of cash crops. Ten respondents that included farmers, physicians, sellers, and researchers stated that land use change was a major challenge for Njavara. Eight people mentioned that this was the case because rice farming was unprofitable. This trend of converting agricultural land from rice and other staple crops to cash crops has also been reported by Kumar [33]. Farmers said that the main reason for cash crops being more profitable was the government policies that encouraged cash crops like rubber and cashew at the expense of rice and other crops.

2. Declining labor availability - Six farmers (n=10) mentioned labour difficulties as one of the major challenges for Njavara cultivation. The main difficulty as explained by farmers seems to be the difficulty in finding labour, as fewer younger people are working in agriculture as other sectors offer better pay. Since Njavara was described as a labour

intensive crop compared to cash crops, production was greatly affected if farmers were unable to find adequate labour when necessary. The reduction in the labour force of Kerala has also been studied by Nair, Menon & Mahesh in their study of combined rice and fish farming in Kerala [35]. They discuss that the number of agricultural employees and workers has dwindled as younger generations seek employment in other sectors such as construction.

3. Government policies - As explained by six interviewees including three farmers and three researchers, there are currently no government policies to support growing Njavara. The government of Kerala does not support the growing of any specific rice variety. One researcher explained that it was difficult to get government support for growing the rice because its medicinal properties have not yet been verified. As explained by one farmer, other government policies have also had negative impacts on the market for Njavara. In 2008, the Government of India banned the export of non-basmati rice and this hurt the growing Njavara export market that was building up for Njavara. As he explained, the ban was only lifted in 2010 and even then only organic rice could be exported.

These external driving factors are not unique to Njavara. The impact of common drivers of change such as commoditization of natural resources, entry of new economic actors, and modernization of healthcare on biological diversity have already been studied [1]. Most often these changes lead to the loss of biodiversity and a shift away from traditional resources use and knowledge [1].

4.3.3. Conservation Lessons

Njavara, the medicinal rice, is worth preserving because of its importance to the people associated with the rice and for the potential future applications of this rice. Many people use the medicinal properties of this rice today, and research indicates that there may be more medicinal value yet to be discovered in Njavara [13, 15]. This rice may also provide valuable genetic material for pest and disease resistance for future rice varieties. As seen from this study, cultivating and selling this rice is an important economic activity for the people involved in the chain. The rice is also associated with the culture of the people

using this rice for in traditional medicine and religious ceremonies. Understanding how this rice has adapted to the changing societal and environmental changes so far provides some ideas regarding future conservation efforts.

When talking about conservation of Njavara, it becomes necessary to define “pure” Njavara and what it is that conservation efforts are trying to preserve. This study shows significant variation of opinion among interviewees about what rice should be called Njavara. Researchers have identified four morphotypes from different parts of the state, but even one of these shows gene introgression, and the medicinal properties of this morphotype have not been verified [10]. If the medicinal properties of this rice is to be preserved, it is essential to describe how exactly the rice can be assessed for medicinal qualities. Preservation of the genetic material in gene banks would separate the rice from the local knowledge system associated with its use and cultivation [36]. In order to ensure in-situ conservation of Njavara, it is important that farmers trying to cultivate this rice have access to this pure seed, because farmers have described lack of access to seed as a challenge for Njavara cultivation. As described by Altieri and Merrick, the seed has to be preserved by the farmers from one generation to another in order to preserve the landrace [37].

For Njavara conservation, the use of the rice has to be maintained in addition to keeping the rice in cultivation. The role of traditional knowledge in conservation in communities has already been studied [38, 39]. The traditional knowledge associated with the use of this rice will play an important role in continued cultivation of this rice. Today, the popularity of this rice is limited to use in two main applications. Although these uses alone may keep conserve this rice, knowledge of the variety of uses is valuable for future medicinal studies. In addition to its value in traditional medicine, cultivation and use of medicinal plants also have special meanings in communities due to being a part of income and cultural identity of the people [40]. In the case of Ayurvedic medicine, this value to people also stems from the spiritual component of health [41]

In the case of Njavara, Geographic Indication certification was introduced in order to ensure the authenticity of the product and increase its marketing potential thereby providing a fair income to its producers. The certification was awarded to a farmer

association to grow black and yellow glumed varieties of Njavara in Palakkad. But this certification is effective only if the special properties of this rice can be linked to its area of cultivation and so far, there seems to be no proof that it has to be grown in certain parts of Kerala for its medicinal properties. Effective GI certification also requires that consumers are willing to pay the additional premium for the authenticity of the product. From this study it seems that the Kerala consumer is very price-conscious, which may be responsible for the presence of “fake” Njavara on the market.

It is important to recognize that any effort to conserve Njavara must take place in the larger context of rice cultivation on Kerala. The challenges faced by rice cultivation throughout the state also need to be considered when considering conservation of this particular variety. Continued cultivation of a landrace in Kerala is becoming more difficult with the increasing popularity of high yielding rice varieties [42]. There are also other factors such as labor shortages and land use changes that make it difficult for farmers to continue growing rice in Kerala. The role of policy encouraging cultivation of rice, and Njavara in particular, need to be taken into consideration when discussing conservation of the rice.

The lessons learnt from the case study of Njavara are applicable to similar situations with other crops in other parts of the world as well. In any situation it is important to recognize the characteristics of the product being preserved and to have clear conservation goals in light of the changes that are occurring in that specific society and environment. Preserving a landrace requires preserving the biological material as well as the cultures and traditions associated with it in order to maintain its value for those involved.

6. Conclusion

In conclusion, this study explores the system of production and cultivation of Njavara in Kerala. It investigates the changes that have affected the rice over the past generation, and explicates the reasons behind many of these changes. This study provides a deeper understanding of how the Njavara system has adapted to changes in socio-economic conditions over the past decades, thus providing some insight into what the future of this rice might look like. Njavara will continue to face challenges in terms of maintaining authenticity while also adapting to changing conditions of rice cultivation in Kerala. The roles of Njavara in medicinal preparations and in religious ceremonies exemplify some of the cultural traditions worth preserving and maintaining this rice variety. Preserving the rice requires conservation of the plant by maintaining the relationship between farmer and the seed, but it also requires continued recognition of the importance of Njavara for the people involved in its chain.

Continuing popularity of this rice for its medicinal properties will play a key role in preserving Njavara. But as the demand for the rice increases, it is essential to take necessary steps to ensure that the authenticity of the rice is maintained. This requires a better understanding of what it is that should be conserved. If the medicinal properties of the rice are to be preserved, further research is required to identify what types of Njavara available today have these properties. Both the biological and cultural diversity associated with this rice need to be maintained in order for this rice to continue being cultivated and consumed. Physicians and consumers must be able to identify this authentic product and be interested in using this genuine product. If this specific knowledge is lost, it is possible that the actual rice continues to decline while the mere concept of Njavara in medicinal use is preserved. Any future action related to preservation of this rice must take into consideration the changing social, economic, and political situation of Kerala in order to ensure measures that can be sustainable in the long term.

Efforts to preserve Njavara are valuable because of the important role of this rice for the people cultivating and using this rice as well as the potential future applications of this variety. The lessons learnt from this case study can also be applied to other landraces

around the world where high yielding varieties and societal changes are prove to be challenges for maintaining these varieties.

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8. Appendix 1: Interview guides

Farmer Interview Guide

- What is your understanding of what Njavara is?
    - What are the uses for this rice?
    - Are there any medicinal properties for this rice?
    - What do you know about the medicinal properties of Njavara?

- Why did you decide to grow Njavara?
    - How did you first hear about growing Njavara?
    - How did you learn to grow this rice?
    - How long have you been growing this rice?
    - Why do you continue to grow this rice?

- How do you grow Njavara?
    - How much area do you use for Njavara production?
    - What difficulties do you have related to growing this rice?
    - What support systems do you have to help you with these problems?

- What is the process of marketing and selling Njavara?
    - What determines the price of the rice?
    - Who is interested in buying the rice?
    - What are the challenges in selling this rice?

- What external factors play a role in your decision to grow Njavara?
    - How do government policies affect your growing decisions?
    - How does the Geographic Indication certification affect growing decisions?

Ayurveda Physician Interview Guide

- What is your understanding of what Njavara is?
    - What are the uses for this rice?
    - Are there any medicinal properties for this rice?
    - What do you know about the medicinal properties of Njavara?
- How do you use Njavara?
    - Where do you get the rice from?
    - How do you prepare the Njavara for use?
    - Has there been an increase or decrease in terms of Njavara use?

- What are the challenges you see related to Njavara?
    - Is there sufficient rice available on the market?
    - Are there any government policies that help or hinder Njavara production and/ or use?

Seller Interview Guide

- What is your understanding of what Njavara is?
    - What are the uses for this rice?
    - Are there any medicinal properties for this rice?
    - What do you know about the medicinal properties of Njavara?

- What is the process of marketing and selling Njavara?
    - How do you obtain the rice?
    - How do you market Njavara?
    - Who are your main customers?
    - How much does Njavara cost?
    - Has there been an increase or decrease in Njavara demand in recent years?

- What is the role of external factors on Njavara sales?
    - How do government policies affect your sales?
    - How has GI certification impacted Njavara?