



PRODUCT REPORT

Raja Zulqarnain Zaka
Assistant Manager (Agri-
Products)

GARLIC

PAKISTAN HORTICULTURE DEVELOPMENT & EXPORT COMPANY

MINISTRY OF COMMERCE

GOVERNMENT OF PAKISTAN

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Product Report on “Garlic”

Section 1: Product Description and Characteristics.

Garlic (Allium sativum)

Family (Amaryllidaceae)

1.1 Origin of Garlic:

Garlic is among the oldest known horticultural crops. In the Old World, Egyptian and Indian cultures referred to garlic 5000 years ago and there is clear historical evidence for its use by the Babylonians 4500 years ago and by the Chinese 2000 years ago. Some writings suggest that garlic was grown in China as far back as 4000 years ago. Garlic grows wild only in Central Asia (centered in Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan) today. Earlier in history garlic grew wild over a much larger region and, in fact, wild garlic may have occurred in an area from China to India to Egypt to the Ukraine. This region where garlic has grown in the wild is referred to as its "center of origin" since this is the geographic region where the crop originated and the only place where it flourished in the wild. In fact, although we sometimes hear about "wild garlic" elsewhere in the world, this is the only region where true garlic routinely grows in the wild without the assistance of human propagation. There are other plants locally referred to as "wild garlic", but these are invariably other species of the garlic genus (*Allium*), not garlic itself (*Allium sativum*). For example, *Allium vineale* is a wild relative of garlic that is found in North America and is commonly called "wild garlic" (USDA, 2006). The "center of origin" for a plant or animal species is also referred to as its "center of diversity" since it is here that the broadest range of genetic variation can be expected. That is why those who have sought to find new genetic variation in garlic have collected wild garlic in Central Asia. Once cultivated by the first garlic farmers outside of its "center of origin", what types of garlic did early afficionados grow? In fact, we know almost nothing about the early types of garlic produced. No description of garlic varieties was made in the early writings discovered to date, be it hardneck or softneck, red or white, early or late, local or exotic.

1.2 Historical/Background:

Garlic is one of the oldest Known Food Flavoring and seasoning plant that managed to infuse itself into culinary tradition of many civilizations across the world. It started its journey in central Asia, domesticated during Neolithic times, spread to the Middle East and northern African countries 3000 BC, which quickly enabled it to reach Europe. Due to its unique nutritional value and wide array of medicinal benefits, this plant was quickly identified as one of the most precious gifts of

our nature, which was expanded with selective breeding into wide array of popular garlic types that are currently used all over the world.

Garlic is the second most widely used cultivated crop after onion. It has long been recognized all over the world as a valuable spice for foods and a popular remedy for various ailments and physiological disorders. Garlic is considered as a rich source of carbohydrates, protein, phosphorous. Ascorbic acid content was reported to be very high in green garlic.

It is grown throughout Pakistan and consumed by most of the people. It is used practically all over the world for flavouring various dishes. In America about 50% of the entire output of fresh garlic is dehydrated and sold to food processors.

In Pakistan, Middle East and other countries, it is already being used in several food preparations especially in dishes, curry powders, curried vegetables, meat preparation, tomato ketchup etc.

The important garlic producing countries in the world are China, Turkey, India, Thailand, Korea, Egypt, etc.

1.3 Economic Importance of Garlic

Garlic is one of the most important herbs. It is used for flavoring food. But over the years, it has also been used as a medicine to prevent or treat various types of diseases. The following are the economic importance of garlic:

Cash crop: USA is said to be the world's largest import market of fresh garlic, followed by Indonesia, France, Germany, Australia and Brazil. Garlic has a great potential in the export, if only we can cultivate it in larger quantities using improved methods and advanced cultural practices. Therefore, it can serve as a source of foreign exchange.

Medicinal purposes: garlic is used as herbal medicine for many conditions related to the blood and heart. It also has antifungal and antibacterial properties.

Flavoring in food: garlic is a common flavoring used in cooking. It serves as a food additive which prevents food poisoning.

Raw material: garlic is used as raw material in pharmaceutical industries. It is used to produce supplements which have enteric coatings.

Low capital requirement: in the presence of a good farm site, garlic production does not require a huge start-up capital. It is less affected by destructive pests and diseases unlike the other vegetables. It does not require sophisticated storage facility and can be stored for a long period of time (up to 12 months) after harvest.

1.4 Economic and Social Impact of the Garlic Crop

One big market that has grown tremendously is garlic. As new crops like garlic gain popularity among residents, farmers quickly adapt to meet this attraction (Noble, 2005), persistent publicity about the health benefits of garlic, and demand from the health supplements industry. Vigorous

demand has resulted in doubling the world garlic production over each of the last two decades. Output was record high and wholesale garlic prices in spring are a third lower than a year earlier. The trend in garlic use is unique among vegetables in that demand has not only increased steadily over many decades but has grown at an increasing rate. Also, despite impressive growth for vegetables such as broccoli, bell peppers, and carrots, no vegetable has experienced stronger growth in demand over the past 10 years as the garlic. The strong surge in use during the 1990's likely reflects several factors:

- rising popularity of ethnic foods and restaurants
- persistent health messages circulating in the press about garlic
- demand from the health supplements industry
- the never-ending quest by consumers for new taste experiences.

These demand factors reflect a broadening view of garlic as a "functional food"--one that imparts both the usual taste and nutritional attributes of food, plus certain perceived health enhancing benefits (broccoli is another example of such a food). Used primarily in cooking to flavor a wide variety of foods, garlic provides vitamin C, potassium, phosphorous, selenium, several amino acids, and a variety of sulfur compounds, including allicin--a naturally occurring compound whose promising health effects are now being studied at several major universities. Garlic has proven itself as a popular food and nutrition item, and is gaining scientific credibility as a significant contributor to good health. Garlic and its benefits are solidly launched, and world production and consumption are likely to continue to grow in the next few years (Agricultural outlook,)

1.5 Nutritional value of garlic:

Particular	Fresh peeled garlic cloves	Dehydrated garlic powder
Moisture%	62.80	5.20
Protein%	6.30	17.50
Fat%	0.10	0.60
Mineral matter%	1.00	3.20
Fiber%	0.80	1.90
Carbohydrates%	29.00	71.40
Calcium%	0.03	0.10
Phosphorus%	0.31	0.42
Potassium%	-	1.10
Iron%	0.001	0.004
Sodium%	-	0.01
Vitamin A.I.U	0.0	175.00
Nicotonic acid(mg/100g)	0.40	-
Vitamin C(mg/100g)	13.00	12.00

1.6 Benefits of Garlic:

1. The Blood Purifier

Garlic is a natural blood purifier. This property of garlic is accredited to the presence of allicin in fresh or raw garlic. Several research and studies have shown that garlic helps in flushing out the toxins from the blood. Also, it has proven anti-bacterial, anti-microbial, anti-fungal, anti-biotic and anti-septic properties that help cleanse the blood and ward off various bacterial, fungal and parasitic infections from body.

2. Cold and Flu

Garlic is going to provide you relief from that stubborn cold and flu. It can boost Immune system, and very beneficial in preventing cold and flu. It contains compounds that fight against germs. Sulfur present in the garlic boosts the disease fighting response of some types of white blood cells in the body when it comes in contact with any kind of viruses, which causes common cold and flu.

3. Prevention of Heart Disease

Consuming garlic on a daily basis (in food or raw) helps to lower cholesterol levels because of the anti-oxidant properties of Allicin. It is also immensely beneficial to regulate blood pressure and blood sugar levels. It is essential to remember that the sulphur-containing compound Allicin tends to lose its medicinal properties when garlic is cooked whole. It is imperative to consume garlic raw or semi-cooked to derive any of its benefits.

4. Anti-bacterial and Anti-parasitic

Garlic is one of the best kept medicinal treasures of the past era - it has been used as an antibiotic to treat bacterial, fungal and parasitic infections for the last 4500 to 7,000 years. Studies suggest diluted garlic extract helps children with tapeworm infections. A garlic-based mouthwash may not sound like fresh, minty breath but a very small quantity of its extracts is sufficient to ward off cavity-causing bacteria.

5. Cancer Prevention

Several studies have indicated an association between daily consumption of garlic and prevention of stomach and colorectal cancers. It is said to strengthen the immunity of the body against cancer.

6. For Skin and Hair

The invigorating properties of garlic protect the skin from the effect of free radicals and slow down the depletion of collagen which leads to loss of elasticity in aging skin. Applied topically, garlic does wonders to skin infected with fungal infections and provides relief from skin ailments like eczema. It is also an effective remedy for fungal infections like athlete's foot and ringworms. Rubbing crushed garlic extract on scalp or massaging with garlic-infused oil is known to prevent and even reverse hair loss.

7. Splinters

Many of garlic's astounding uses were forgotten in the folds of time but users (and believers) still vouch for the lesser-known benefits. One of them is against stubborn splinters. Place a piece of cut garlic over the splinter cut and cover with a bandage- and voila!

Cautions:

- Asthma patients should not consume garlic as it may have side-effects.
- Garlic should be avoided before surgeries or medical operations.
- Do not consume more than 2-3 garlic cloves in a day without consulting a doctor.

1.7 Garlic value-Added Products:

One of the best ways to turn garlic into profits is to make value-added products that will not only enhance its price but also keep it safe until sold.

Growers have several ways to boost their income from garlic by processing the harvested cloves, adding garlic to other products, or creating new value-added products. By taking a few simple additional steps, they can turn their harvested garlic from a simple food item to valuable products that can double, even triple profits. A list of such products is given below:

- Garlic Powder
- Pickled Garlic
- Garlic Scapes
- Garlic Sauce
- Garlic Vinegars
- Garlic Jelly
- Garlic Insecticide
- Garlic Flakes
- Garlic Chips
- Garlic Enriched Miki Noodles
- Garlic Soups

Source: www.Profitable plant digest.com.

1.8 Global Production Spread of Garlic

The famous French chef, X. Marcel Boulestin (1878-1943), is reputed to have said, "It is not really an exaggeration to say that peace and happiness begin, geographically, where garlic is used in cooking." (Agricultural Outlook, 2000). Garlic is a crop widely grown for fresh market by many producers on a small scale for local markets and, particularly in the U.S., by a few large-scale producers for processing and fresh sales. About one million hectares (2.5 million acres) of garlic produce about 10 million metric tons of garlic globally each year, according to the United Nations Food and Agriculture Organization (FAO). Garlic is one of the most popular spices in the world. It is reported that in ancient Egypt, the workers who had to build the great pyramids were fed garlic daily, and the Bible mentions that the Hebrews enjoyed their food with garlic. In the first world war, garlic was widely used as an antiseptic to prevent gangrene and today people use garlic to help prevent atherosclerosis and improve high blood pressure (Hedrick, 1972). Although widely cultivated, it is only since routine seed production became possible in the 1980's that garlic can be called a domesticated crop, since a strict definition of domestication is the process of selective breeding of a plant or animal to better meet human needs. Clones held by growers today have been maintained as separate entities, but a system to confirm or refute the identity of a given clone has

not been established. Only with several seasons of careful field observation can garlic clones be identified, and even then ambiguities often remain. For example, virus infection can dramatically reduce plant size and vigor, and alter leaf color and shape (USDA, 2006). There are about 300 varieties of garlic cultivated worldwide, particularly in hot, dry places. Today, garlic is one of the twenty most important vegetables in the world, with an annual production of about three million metric tons. Major growing areas are USA, China, Egypt, Korea, Russia and India (Innvista, 2005). Garlic has been used as both food and medicine in many cultures for thousands of years, dating as far back as the time around 4500 to 7,000 that the Egyptian pyramids were built. Later, gravediggers in early eighteenth-century France drank a concoction of crushed garlic in wine which they believed would protect them from getting the plague that killed many people in Europe. More recently, during both World Wars I and II, soldiers were given garlic to prevent gangrene, and today people use garlic to help prevent atherosclerosis (plaque buildup in the arteries causing blockage and possibly leading to heart attack or stroke), improve high blood pressure, and reduce colds, coughs, and bronchitis (UMM, 2004).

1.9 Global consumption Trends of Garlic

In 2018, global garlic consumption stood at \$18.1bn, +8% more than the year before - this figure reflects total revenue of producers and importers (excluding logistics costs, retail marketing costs, and retailers' margins, which will be included in the final consumer price). As a whole, the value of the global garlic market indicated an upward trend over the period from 2010 to 2019, however, the trend pattern was not consistent.

While from 2010 to 2019, the world garlic market was growing steadily, this growth was followed by a decline in market volume over the next year. From 2010 to 2011, the global garlic market increased significantly, until garlic market slipped back again over the next year. In physical terms, the global garlic consumption grew by +3.2% per year, amounting to 26.5 million tonnes in 2016. From 2010 to 2016 garlic market grew steadily. Given the stability of consumption volumes in physical terms, fluctuations in market value could be explained by price changes.

1.10 Consumption of garlic is expected to exceed 31.1 million tonnes by 2025

Garlic is one of the most important ingredients in world cuisine, and it is used in cooking of numerous cold appetizers and sauces, or as a seasoning.

It is anticipated that the next nine-year (2016 to 2025) will see an upward trend in garlic cultivation due to a number of factors, such as the growth of the population in general, the growth in demand for nutritious food coupled with implementation of government assistance measures (especially in Asian producing countries), the growth of cultivation areas, and the search for frost-resistant varieties of garlic. Taking all these factors into consideration, market performance is forecast to grow with an anticipated CAGR of +1.8%, which will bring the market volume to 31.1 million tonnes by 2025.

Source:Fao.org

Section 2: Production Technology of Garlic

2.1 Production Technology

2.1.1 Soil:

For Garlic fertile, well drained and loamy soil is required for high yield. Heavy and hard soil significantly affect the bulb size and yield.

2.1.2 Climate

Garlic is frost resistant crop and it requires cool period during early growth and dry period near maturity. The increase in day length from 8 to 12 hours. increases the bulb weight, bulb diameter and number of cloves and reduces the number of secondary leaves.

2.1.3 Time of Planting & Method of Sowing

Garlic is planted in single clove but bulbils (a small young plant that is produced vegetatively from axillary buds on parent plants stem) are also used occasionally. The quantity of planting material required per area depend on clove size and number of cloves per bulb. A distance of 15 to 20 cm (row to row) and 8 to 10 cm (plant to plant) is recommended. The sowing of garlic in the provinces is as under:

Province	Sowing Time
Punjab	October
Sindh	October - November
Khyber Pakhtunkhwa	October - November
Balochistan	October - November

2.1.4 Manuring and Fertilizer Requirement

Garlic responds very well to organic manure, Application of 5-10 tonnes/acre at the time of field preparation is recommended. Application of N: P: K @ 75:85:55 kg produces higher yield. At the time of planting, half of nitrogen along with full dose of P and K should be used, the remaining half of nitrogen be applied 30-45 days after planting.

2.1.5 Irrigation and interculture

Garlic crop needs irrigation once in a week during vegetative growth and at 10-15 days' interval near maturation. Garlic is a closely planted crop which requires 3-5 manual hoeing for higher yield. However, weeding is tedious, expensive and often damages the plants therefore, weeds can be controlled by using oxadiazon (0.5 lit/acre) and pendimethalin (1.0 lit/acre), as pre-emergence weedicides.

2.1.6 Harvesting

The crop is ready for harvest when the tops turn brownish and show signs of drying up and bend over. The bulbs mature in 4-6 months after plantation depending upon the climate. The harvesting time is as under:

Province	Harvesting Time
Punjab	April
Sindh	April - June
Khyber Pakhtunkhwa	March - June
Balochistan	March - June

2.1.7 Storage

Garlic bulbs can be best stored for 3-4 months in well ventilated room. Storability is also affected by enzyme activity and the cultivars most suitable for storage generally have low ascorbate and polyphenol oxidase activity. Application of 2500 or 5000 ppm MH as foliar spray before harvest is reported to inhibit sprouting in storage up to 300 days without any appreciable adverse effects on yield. The treatment also reduces the loss in weight of bulbs stored at low temperature (1.0 to 8.0C).

2.2 Common pests and diseases and suggested remedies:

2.2.1 Diseases:

Fungal diseases:

2.2.2 Downy mildew (peronospora destructor)

Symptoms:

- Pale spots or elongated patches on leaves
- Gray-purple fuzzy growth on leaf surface
- Leaves turning pale then yellow
- Leaves tips collapsing

Management:

- Avoid planting infected seeds
- Rotate crops to non-allium species for 3-4 years
- Destroy all infected crop debris
- Apply appropriate foliar fungicides

2.2.3 purple blotch (*Alternaria porri*)

Symptoms:

- Small water-soaked lesions on leaves
- Brown to purple in color with red or purple margin surrounded by yellow zone

Management:

- Cultural controls include long rotations with non-hosts
- Reduction of leaf wetness by planting in well-draining soil

2.2.4 Rust (*Puccinia porri*)

Symptoms:

- Small white flecks on leaves and stems which develop into circular or elongated orange pustules
- Severe infestations can cause leaves to yellow and die

Management:

- No resistance known
- Use only disease free seed and plant in well-draining soil
- Apply appropriate protective fungicide.

2.2.5 White rot (*sclerotium cepivorum*)

Symptoms:

- Older leaves yellowing
- Stunted growth
- White growth on base of bulb which spreads up bulb to storage leaves

Management:

- Treat seeds with hot water prior to planting
- Use a long term rotation with non-allium crops
- Fungicide treatment may not be effective control may have to rely on cultural methods

2.2.6 Viral diseases:

Mosaic: Garlic mosaic virus

Symptoms:

- Mosaic patterns on leaves
- Chlorotic mottling or streaks on leaves
- Stunted plant growth and reduced bulb size

Management:

- Plant virus free cloves that were produced from meristem tip culture in virus-free conditions

2.3 Pests of garlic:

2.3.1 Mites:

Symptoms:

- Stunted plant growth
- Reduced stand
- Bulbs rotting in ground or in storage

Management:

- Do not plant successive crops of garlic in same location
- Treating garlic seed cloves with hot water prior to planting may help reduce mite population

2.4 Insects of garlic:

2.4.1 Leaf miners:

Symptoms:

- Heavy mining can result in white blotches on leaves
- Leaves dropping from the plant prematurely

Management:

- Remove plants from soil immediately after harvest
- Only use insecticides when leaf miner damage has been identified

2.4.2 Thrips:

Symptoms:

- Discolored, distorted tissue
- Scarring of leaves
- Severely infected plants may have a silvery appearance

Management:

- Avoid planting garlic in close proximity to grain fields as thrips populations
- Apply appropriate insecticides at first sign of strips damage.

References

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Section 3: Global Production, Yield and Consumption

3.1 Production share of Garlic by region

Average 1994 - 2018

Serial number	region	Production (Tons)
1	Asia(89.2%)	15,677,496.12
2	Europe(4.3%)	758,423.76
3	America(3.8%)	668,931.64
4	Africa(2.7%)	467,193.88
5	Oceania (0%)	1,505.208
Total Average Production (1994-2018)		17,573,550,.608

Source: www.fao.org/faostat/#data

3.1.1 Production Share of Garlic by region 2018

Serial number	region	Production (Tons)
1	Asia	26,058,952
2	Europe	862,849
3	America	832,990
4	Africa	737,345
5	Oceania	1,995
Total Production 2018		28,494,130

Source: www.fao.org/faostat/#data

3.1.2 Region Wise Production analysis:

According to the United Nation's Food and Agriculture Organization (FAO) estimates world production of garlic is 28,494,130 metric ton (MT) approximately. Asia is the largest garlic producing continent in the world and it contributes more than 90% to the total world garlic production. China is the leading garlic producing country in 2018, which produced 22,333,877 (MT) of garlic accounting for over 77% of world output followed by India, Bangladesh, South Korea, Egypt, Russia, Myanmar, Ethiopia, USA, and Ukraine respectively (FAO, 2018).

Main reason of large production in Asia is suitable climate, and weather conditions as compared to other regions.

3.2 Global Garlic production (Quantity: tons)

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
World	22,140,286	22,574,817	23,087,092	23,407,012	24,248,778	25,006,820	26,692,650	26,821,718	27,648,023	28,494,130
China	17,967,857	18,548,669	18,507,634	18,491,574	19,227,341	20,061,419	21,519,051	21,288,993	21,802,887	22,333,877
India	831,100	833,970	1,057,800	1,228,000	1,259,000	1,252,000	1,425,000	1,617,000	1,693,000	1,721,000
Bangladesh	154,831	164,392	209,153	233,609	223,685	312,000	345,725	381,851	425,401	461,970
Korea	357,278	271,560	295,002	339,113	412,250	353,761	266,272	275,549	303,578	331,741
Egypt	195,743	244,626	295,845	309,155	234,164	263,167	290,894	272,769	289,766	286,213
Spain	154,587	136,561	140,762	154,363	173,600	177,420	178,416	209,795	274,712	273,476
U.S.A	175,900	170,190	190,690	195,910	175,400	175,450	185,460	204,780	231,993	260,340
Uzbekistan	49,200	45,700	127,633	139,884	203,585	154,130	165,762	200,869	214,263	254,857
Russia	227,272	213,483	233,948	239,312	232,843	256,406	254,877	202,992	206,074	211,981
Myanmar	197,600	206,000	209,300	208,800	212,000	208,900	209,125	212,909	203,674	207,094
Algeria	59,932	64,494	53,981	77,648	93,062	92,205	110,007	103,627	123,475	202,201
Ukraine	150,100	157,400	171,900	171,400	185,570	191,140	176,470	187,960	185,830	187,020
Argentina	144,044	142,620	143,308	143,996	144,684	146,417	149,374	147,009	147,582	148,156
Turkey	105,363	98,170	100,648	105,201	114,967	116,089	119,223	135,148	148,133	143,207
Ethiopia	179,658	128,441	123,962	222,548	159,094	93,486	118,767	138,664	116,972	124,801
Brazil	86,752	104,124	143,293	107,009	102,232	93,769	117,272	132,361	120,896	118,837
Peru	57,989	62,962	88,468	82,165	81,407	81,505	89,752	78,205	94,887	104,574
Mexico	56,088	47,429	58,065	54,015	59,015	54,724	58,757	75,987	89,840	94,692
Pakistan	67,204	57,229	55,308	57,335	60,611	64,473	72,987	70,925	73,002	74,467

Source: Fao statistics.

3.3 Global Area under cultivation of Garlic(Hectares)

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
World	1,309,400	1,337,114	1,384,822	1,445,814	1,429,461	1,413,338	1,479,007	1,484,129	1,538,412	1,546,741
China	779,232	804,144	794,417	800,497	782,621	789,641	821,776	792,361	791,916	793,169
India	166,210	164,860	200,600	242,000	248,000	231,000	262,000	281,000	321,000	303,000
Bangladesh	34,319	37,055	41,997	44,284	42,493	53,000	57,049	60,776	66,259	71,414
Korea	26,323	22,414	24,035	28,278	29,352	25,062	20,638	20,759	24,864	28,351
Egypt	7,329	9,674	12,145	12,296	9,304	10,997	12,589	12,875	13,022	12,782
Spain	15,919	14,850	15,750	17,494	18,800	20,963	19,996	24,317	26,630	28,428
U.S.A	9,000	9,250	10,180	10,500	9,670	9,630	10,200	12,180	13,353	13,273
Uzbekistan	2,546	2,600	4,412	3,090	5,156	5,100	5,000	5,821	6,878	9,572
Russia	27,170	26,793	26,794	27,689	27,498	28,460	28,425	21,690	21,450	21,926
Myanmar	28,328	29,137	29,137	28,733	29,137	28,328	28,177	28,682	27,674	28,090
Algeria	11,193	10,574	9,503	9,055	8,556	9,197	10,022	9,445	9,912	12,945
Ukraine	18,900	19,500	21,200	22,500	22,710	21,900	20,800	21,000	21,500	22,200
Argentina	14,928	14,895	14,975	15,056	15,136	15,212	15,475	15,313	15,380	15,446
Turkey	11,389	11,467	11,142	13,864	12,569	12,723	13,271	15,167	16,669	16,080
Ethiopia	15,361	10,690	13,279	21,258	16,411	9,258	11,846	15,381	12,058	12,429
Brazil	10,063	10,450	12,928	10,064	9,567	9,638	10,789	11,404	10,588	10,557
Peru	5,916	6,360	8,590	7,657	7,737	7,573	8,469	7,699	8,790	9,817
Mexico	5,674	4,909	5,675	5,299	5,310	5,430	5,510	6,437	7,219	7,348
Pakistan	8,357	6,856	6,521	6,768	7,091	7,430	7,973	8,145	8,234	7,882

Source: Fao Statistics.

3.4 Global yield of Garlic (tons per hectare)

country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
World	16.91	16.88	16.67	16.19	16.96	17.69	18.05	18.07	17.97	18.42
China	23.06	23.07	23.30	23.10	24.57	25.41	26.19	26.87	27.53	28.16
India	5.00	5.06	5.27	5.07	5.08	5.42	5.44	5.75	5.27	5.68
Bangladesh	4.51	4.44	4.98	5.28	5.26	5.89	6.06	6.28	6.42	6.47
Korea	13.57	12.12	12.27	11.99	14.05	14.12	12.90	13.27	12.21	11.70
Egypt	26.71	25.29	24.36	25.14	25.17	23.93	23.11	21.19	22.25	22.39
Spain	9.71	9.20	8.94	8.82	9.23	8.46	8.92	8.63	10.32	9.62
U.S.A	19.54	18.40	18.73	18.66	18.14	18.22	18.18	16.81	17.37	19.61
Uzbekistan	19.32	17.58	28.93	45.27	39.49	30.22	33.15	34.51	31.15	26.63
Russia	8.36	7.97	8.73	8.64	8.47	9.01	8.97	9.36	9.61	9.67
Myanmar	6.98	7.07	7.18	7.27	7.28	7.37	7.42	7.42	7.36	7.37
Algeria	5.35	6.10	5.68	8.58	10.88	10.03	10.98	10.97	12.46	15.62
Ukraine	7.94	8.07	8.11	7.62	8.17	8.73	8.48	8.95	8.64	8.42
Argentina	9.65	9.58	9.57	9.56	9.56	9.63	9.65	9.60	9.60	9.59
Turkey	9.25	8.56	9.03	7.59	9.15	9.12	8.98	8.91	8.89	8.91
Ethiopia	11.70	12.02	9.34	10.47	9.69	10.10	10.03	9.02	9.70	10.04
Brazil	8.62	9.96	11.08	10.63	10.69	9.73	10.87	11.61	11.42	11.26
Peru	9.80	9.90	10.30	10.73	10.52	10.76	10.60	10.16	10.79	10.65
Mexico	9.89	9.66	10.23	10.19	11.11	10.08	10.66	11.80	12.44	12.89
Pakistan	8.04	8.35	8.48	8.47	8.55	8.68	9.15	9.00	9.11	9.6

Source: Fao Statistics

3.5 Country Wise Production analysis: -

Review of the above data shows a rise, through small, in world production of garlic over the last ten years, China is top producer of Garlic from last ten years, with average of 79% Share in world production, India is 2nd largest producer of Garlic. While Bangladesh is world's 3rd largest producer of Garlic,

China has been promoting garlic as a model producer since 2001 and it is by and large the market leader in its production and export.

3.6 Global Garlic Production posted moderate gains

Production of garlic stood at \$18.6bn in 2018, which was \$1.5bn (or +9%) more than in 2017. In general, the production of garlic in value terms has had an upward trend since the beginning of the period up to 2009, when it started to decline as a result of lower producer prices. It was only in 2018 when production recovered and reached its new peak.

In physical terms, garlic production stood at 28.5 million tonnes, However, overall, the global garlic production grew by +3.1% over the period under review.

In 2018, harvested area of garlic amounted to 1.5million ha, which increased gradually from 2009 to 2018. Garlic yield also grew gradually from 16.91 tons/ha in 2009 to 18.42 tons/ha in 2018.

3.7 China Remains the largest Garlic Producer in the World

In 2018, China was the largest and main garlic producing country in the world accounting for around 80% of world production. It was followed by India (5%), Bangladesh (1%), Egypt (1%), the Republic of Korea (1%), Russia (1%), and Myanmar (1%), however, these countries comprising only 10% of total output.

Bangladesh (+8.9%) and India (+6.8%) had the highest growth rate in garlic production among leading producing countries. The major producer of garlic – China (+3.2%), however, had more moderate paces of growth, over the same period.

However, among the main producers, the largest harvested areas were in China (54%) and India (18%), together accounting for 72% of harvested area in the world. The largest yield had China (28.16 tons/ha), Egypt (22.39 tons/ha), and the Republic of Korea (11.70 tons/ha) in 2018.

3.8 Overview Global Garlic Market

The garlic market is virtually empty. Stocks are very limited and the little that comes in is quickly sold out. In South Africa this is currently resulting in very high prices on the domestic market. Other countries are taking advantage of the situation, including Egypt, which is seeing its exports increase very strongly. We are now waiting for the new harvest from China and Spain. The garlic is looking good in the fields, but the question is whether there will be enough workers to harvest it.

3.8.1 The Netherlands: All the garlic that comes in is quickly sold out

Due to the coronavirus, a large unexpected demand for garlic has been recorded, and according to a Dutch importer, this has caused a shortage that could last for several weeks. The entire supply chain has been affected and all importers have been hit. All the garlic that comes in is quickly sold out.

In Spain, there is a shortage of workers and there are pretty much no stocks left; a situation that also affects the Chinese harvest. The question now, before the new harvest arrives in Spain and China, is whether there are still enough workers available for the handling and packaging of garlic. In the fields, the crop is doing well, but that does not guarantee an end to the market shortages.

3.8.2 Germany: Market characterized by shortages

Due to the lockdown, there has temporarily been little supply from China. In Spain too, the available volume is barely sufficient, although German importers are looking for alternative suppliers. There is therefore scarcity across the board. Since a new harvest will soon be arriving from the main Spanish growing areas, stocks are now being used up as much as possible. Garlic is apparently still perceived as a healthy product that strengthens the immune system. This market situation is logically having an impact on prices, which have been skyrocketing."

3.8.3 France: Market is almost empty due to high demand

Garlic has been one of the products with the fastest-growing demand during the crisis. The French market is almost empty and the same applies to neighboring Spain. Given the big demand, the question is whether there will be enough stock until the next harvest in Spain. This year, the harvest should hit the market earlier than usual. In south east France, fresh garlic is already available on the market, but the volumes are still small. The first dried purple garlic should hit the market around mid-July, followed by white and pink garlic. There are no problems in the field this season.

3.8.4 Spain: Growers are concerned about labor shortages

The price for Spanish garlic has risen by 15% since January. The demand is high due to global market shortages. The new season's harvest will start in early May in Andalusia. Although the floods have not caused any damage here, the growers are keeping a close eye on the quality. The main concern for the growers is the shortage of pickers for the coming season. Due to the measures

taken against the coronavirus, the borders remain closed and migrant workers cannot travel to Spain. The garlic harvest is very labor intensive. The Spanish government is trying to cover those jobs with the temporarily unemployed, but it takes time to train these inexperienced employees in picking garlic. According to the sector, the best solution is the German model, with temporary work contracts for migrant laborers working in the agricultural and horticultural sector.

3.8.5 Italy: Higher prices are welcome for garlic growers

A trader from northern Italy says that Egypt, which has always been relatively less attractive for imports, has now become interesting, with much higher prices than in previous years. "We will start selling Egyptian garlic. Italy will start the new harvest at the end of June, so there are still about two months to go. The acreage is comparable to last year's; however, producers are concerned about the lack of laborers." The market for organic products is more stable. "The production there is reserved for specialized customers and here too the price has risen considerably."

In central Italy, a large producer has expanded the acreage from 40 to 55 hectares, since the demand keeps increasing. He currently has no production available. Prices have been satisfactory.

3.8.6 Egypt: Taking advantage of market shortages

The garlic volumes available this season are comparable to last year's. The fresh garlic season has just come to an end and the switch to dried garlic has already been made. The demand is high at the moment, giving Egypt new opportunities to enter new markets. For example, exports to Brazil (this market opened to Egypt last year) have risen again. The demand for Egyptian garlic has also risen in Canada, USA and South Africa.

3.8.7 South Africa: Very high garlic prices

At the moment, the garlic in South Africa comes from Spain and China. Reportedly, there have been some disruptions in the logistics and there is a consistently low supply on the market. The price amounts to around 91 ZAR (€ 4.43) per kilo and is therefore very high (over 233% higher than in the same period last year). This is not only due to the market situation, but also to the exchange rate and a weak currency. More than 60% of the garlic is imported. Local growers have been planting garlic; however, a number of them have stopped because they were unable to compete against imports. Some retailers say that they prefer the in-season domestic product.

3.8.8 Peru: Market benefited from high import tariffs on Chinese products

Garlic cultivation takes place mainly in southern Peru and is intended for Mexico, Brazil, the US and Australia. The campaign runs from September to January, with some smaller volumes from July. In the latest season, the sizes have been smaller than usual. More exports have gone to the US thanks to the high import tariffs on Chinese garlic, and subsequently to the product shortages. However, the US mainly demands white garlic, while Peru mostly grows colored varieties.

3.8.9 Chile: Exports to Brazil have grown

The harvest started in November, with the peak between January and March. The main variety is the Chinese purple garlic and the biggest export destinations are Mexico and Brazil. Prices are better than last year. Back then, prices were poor due to competition from China. Brazil is buying more Chilean garlic; as anti-dumping measures have made Chinese garlic more expensive.

3.8.10 Mexico: Hardly any stocks left due to increased demand

The Mexican season runs from March to the end of July with a lot of cultivation of Chinese purple garlic and white garlic here and there. Demand is currently higher than usual due to a shortage of imports from China.

3.8.11 China: Price drop is expected in the coming weeks

The garlic market is very unpredictable this year. The problems in China were quickly resolved and all companies were able to produce and export again; however, due to the further spread of the coronavirus worldwide, importing countries are now struggling with their logistics and this sometimes causes delays. Chinese companies are now also extra careful and are making clear agreements before exporting. The price is expected to fall in the coming weeks, but it remains unclear when that is going to happen. The price will drop anyway, because when the new garlic hits the market, the old garlic will automatically lose part of its value and the price for it will fall.

3.8.12 North America: High prices due to dried up stocks

Garlic stocks are also limited on the North American market. The shutdown of imports from China, which accounts for 80% of the world's garlic trade, had an impact on the market in Canada and the USA. Due to the loss of this import channel, the importers focused on Argentina and Spain, as well as closer to home, on California and Mexico. These stocks soon dried up due to the sharp increase in the demand, so now it is time to wait for the new harvest from Spain, Mexico and China. Some of the supplies currently come from California, where smaller sizes are now also being sold. On the continent, prices have even tripled in some cases. The garlic harvest in California is now entirely devoted to the retail, given that the foodservice was closed down in the first week of the measures. The demand from this sector is now back at 15-20% of what it normally is.

3.8.13 Australia: Imports up by 7%

The country is only a small player on the world stage when it comes to garlic cultivation. In 2019, the production amounted to 2,812 tons, and 13,060 tons were imported, out of which just under 10,000 tons came from China. Imports increased by 7%.

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3.9 Global Varieties of Garlic:

Garlic Variety Descriptions Including a Brief Variety Overview:

3.9.1 Overview

There are literally hundreds of named garlic varieties! However, they all divide into two subspecies typically called hardneck and softneck. The farther north you plant, the easier it is to grow hardneck garlics and the farther south you plant the easier it is to grow softneck garlics. What people call supermarket garlic is usually grown in southern China or California and is from the softneck subspecies. Within these two subspecies, there are further divisions into ten fairly distinct varietal groups such as Porcelain, Purple Stripe, Artichoke, Rocambole, etc. Hardneck garlics are the earliest cultivated garlics as determined by genetic testing and originally come from the Caucasus Mountains in central Asia. Hardneck garlics are called hardneck because they produce a stiff flower stalk called a scape while softneck garlics do not.

Garlic varieties differ a lot in size, color, shape, taste, and number of cloves per head. Garlic is also quite sensitive to soil and climatic conditions and an identically named garlic can be quite different from farm to farm. You can even find significant differences year-to-year in the same location similar to how grape wine varietals change every year. On top of all that, the same garlic tastes differently to different people as you can see when you look at our taste tests. Again, this is similar to how people react differently to the same wine or beer.

3.9.2 HARDNECK VERSUS SOFTNECK

In the early 1990's, farmer and author Ron engeland, proposed that garlic be separated into two major subspecies. The two groups were divided based on the plants tendency to go to flower. The hardneck vs. softneck classification was born, with roots of this distinction dating back to its first cultivation in Southern Europe.

3.9.3 Hardneck varieties produce a garlic scape that unfolds into an edible flower at sexual maturity. When plants reach full maturity and are preparing to go dormant for the winter season, the flower develops into bulbils that can be planted, just like the cloves. Often growers choose not to plant bulbils as the plants that grow from these materials are variable in size and quality, unlike the clones which are usually true to the plants from the previous season. There are many theories and methods when it comes to growing garlic, but many people who grow hardneck varieties remove the scape during production to concentrate the plant's efforts towards developing large cloves. Garlic scapes are edible and are often desirable additions to market tables and sought out by restaurants for their mild and somewhat sweet, garlic flavor. Hardneck garlic has larger cloves than softneck varieties and generally offers something between 4-12 cloves per bulb. Hardneck varieties are favored in colder climates for their winter hardiness, but have adapted to many different regions.

3.9.4 Softneck varieties are one of the most common grocery store garlic types and generally have larger bulbs. The bulbs tend to have significantly more cloves than hardneck varieties, sometimes

numbering 8-20 cloves per bulb. It is thought that the additional cloves are a safeguard by the plant to reproduce as softnecks rarely produce flowers. If softnecks do produce a flower, it is generally due to stress and will often times be malformed or appear within the bulb itself. Softneck garlic is favored in warmer climates and stores very well, maintaining its integrity for up to 12 months in ideal storage conditions.

3.9.2 HARDNECK

ROCAMBOLE:

Rocamboles are some of the most widely known hardneck varieties. They have what is considered "true garlic flavor" and loose skins that make them easy to peel when cooking.

PORCELAIN:

Porcelain garlic varieties are popular for use in the kitchen as their cloves can often get as large as those found in elephant garlic bulbs. These garlic varieties are great for high altitudes and cooler climates and offer great spice raw or cooked.

PURPLE STRIPE:

These hardneck varieties offer a beautiful purple coloring on the skins of the cloves found within the garlic bulb. Grown in many different climates, these varieties often win taste test competitions for their flavorful and aromatic nature.

3.9.3 SOFTNECK

SILVERSKIN:

These softneck varieties offer the longest storage capacity of all of the garlic types. These high yielding varieties are acclimated to many different climates. They are very popular for those interested in making garlic braids.

ARTICHOKE:

Artichoke garlic varieties are the easiest garlic varieties to grow and some of the most productive. These varieties can be grown in close to any climate. Artichoke garlic varieties offer a wide diversity of flavors ranging from hot and spicy to mild and sweet.

BLACK AND SMOKE GARLIC:

More fashionable in recent years, both are modern inventions. Black garlic is fermented at high temperature to give a sweet, yeasty taste that some cooks use to boost flavour. I have had no joy from it. Smoked garlic is generally made, like smoked fish, with oak chips – the process doesn't add any extra life to the bulb. But, roasted, its good spread on toast as a bruschetta.

WILD GARLIC:

The lush sword-like leaves that grow in damp patches in British woodlands from early spring are the product of a different species of allium. But they're a lovely taste of the new season. You can use them, or the little white flower heads that arrive later in salad, stuff a roast chicken with them, or crush them into a pesto sauce with some basil and olive oil.

Source:<https://www.highmovingseeds.com/garlic-the-traveler-from-origins-to-cultivation/>

3.10 Consumption Pattern of Garlic including consumption per capita

In terms of quantity, China was the largest garlic market in the world with 75% share. It was followed by India (5%), Indonesia (2%), Bangladesh (2%), Russia (1%), the Republic of Korea (1%) and Brazil (1%). The above countries together account for about 87% of the world consumption of garlic. In addition, most of these countries, except for Indonesia, were also the leading producers of garlic in the world.

Amongst these countries, Bangladesh (+7.4%) and India (+6.5%) had the highest annual growth rates of garlic consumption over the period under review.

China constitute the largest garlic markets. In addition, this country had the highest volume of per capita consumption: 14.3 kg/per person. At the same time, other consuming countries - the Republic of Korea (6.2 kg/person), Bangladesh (2.6 kg/person), Russia (2.2 kg/year), Indonesia (1.8 kg/person), Brazil (1.5 kg/person) and India (1.1 kg/person) - had the lowest volume of garlic consumption.

Source:Fao.org

3.11**world Consumption Of Garlic**

Year	Production (Tonnes)	Less Wastage (30% of Total Production) (Tons)	Total Consumption (Tons)	Total Consumption (K.G's)	Population	Per Capita Consumption (K.G's)
2009	22,072,428	6,621,728.40	15,450,700	15,450,699,600	6,841,000,000	2.26
2010	22,574,817	6,772,445	15,802,372	15,802,371,900	6,923,000,000	2.28
2011	23,087,092	6,926,128	16,160,964	16,160,964,400	7,004,000,000	2.31
2012	23,407,012	7,022,104	16,384,908	16,384,908,400	7,087,000,000	2.31
2013	24,248,778	7,274,633	16,974,145	16,974,144,600	7,171,000,000	2.37
2014	25,006,820	7,502,046	17,504,774	17,504,774,000	7,256,000,000	2.41
2015	26,692,650	8,007,795	18,684,855	18,684,855,000	7,341,000,000	2.55
2016	26,821,718	8,046,515	18,775,203	18,775,202,600	7,426,000,000	2.53
2017	27,648,023	8,294,407	19,353,616	19,353,616,100	7,511,000,000	2.58
2018	28,494,130	8,548,239	19,945,891	19,945,891,000	7,594,000,000	2.63

Analysis:

World consumption trends shows that in 2009, per capita consumption is 2.26kg, and in 2018 per capita consumption is 2.63kg, the data shows that world per capita consumption is increased from 2009 to 2018.

Section 4: Domestic Production, Yield and Consumption

4.1 Production of garlic in Pakistan:

- Total production of garlic in the country was 74500 metric tons during 2018. Entire garlic production of the world is concentrated in countries, out of which top 5-10 producers account for 90% of total production.
- Pakistan ranks 19th in world production with 0.3% share in world production. (2018).
- Due to negligible production of garlic, Pakistan meets its requirements through imports. It ranks 11th in garlic import and market share in global import market is 1.9%. (\$ 36,073 M) import. (2018).
- Pakistan ranked 28th in world export. And 0.1% share in global export (\$1.26M). (Source:Fao.com). (2018).

4.2 Varieties of garlic in Pakistan and their characteristics:

- Silver skin Garlic
- Artichoke Garlic
- Swat white
- NARC-G1
- Lehson Gulabi or pink garlic
- Desi white Garlic
- AR212
- Buner Local

4.2.1 Silver skin Garlic:

"Silver skin are among the most long-storing garlic cultivars. they are also called Italian garlic and Egyptian garlic. If storage conditions are favorable, well-grown bulbs can be stored for up to a year or more. Silver skin are notoriously hot and aggressive in character. Leaves are narrow and blue-green, and more vertically angled than Artichoke cultivars and have a pronounced bilateral symmetry. The leaf characteristics of Silver skin, combined with their compact, teardrop shaped bulbs and long storage ability, make these cultivars the chosen garlic for braiding.

4.2.2 Artichoke Garlic:

Artichoke garlic has a milder flavor and may have fewer and larger cloves than silver skin. You can store it as long as eight months. Artichoke garlic may occasionally have purple spots or streaks on its skin, but don't confuse it with purple stripe garlic, a hardneck variety that has quite a bit of purple coloring.

4.2.3 Swat white:

It is the most traditional and common garlic. With a mild taste and persistent aroma, it is larger than the Purple Garlic and it also matures before the latter. It has good preservation, it is of late harvest and good productivity although it is especially sensitive to freezing. swat white garlic

heads usually have more cloves than other types, they are white and are covered with a silvery parchment-like wrapping.

4.2.4 NARC -G1:

It is the best variety of Pakistan and is suitable for growing in all provinces of the country. NARC-G1 is the highest yield variety among all the existing varieties in the country, it has higher nutrient contents and best survival rate (100), minimum and wider leaves plant, average plant height (38.2cm), minimum cloves (8.3) per bulb and comparatively larger bulbs maximum bulb weight (126.6 gm) and maximum yield (26 t /ha),

4.2.5 Lehson Gulabi or pink garlic:

pink garlic is characterized by its pink colour. its extended dormancy (allowing its delayed marketing until spring) and by its rigid floral stem that produces clusters of garlic (called "manouilles") instead of braids as with traditional garlic. The garlic has a highly developed flavor. Due to the extended drying time (a minimum of 15 days), it is well-suited to long-term storage.

4.2.6 Desi White Garlic:

It is white in colour and have big sized bulbs. It is the most traditional and common garlic. With a mild taste and persistent aroma. Desi white garlic heads usually have more cloves than other types. they are notoriously hot and aggressive in character.

4.2.7 Buner Local:

It has a milder flavor and may have fewer and larger cloves, Buner local may occasionally have purple spots or streaks on its skin, it has long storage ability, its usually grown in province of Khyber-Pakhtunkhwa,

4.2.8 High yield garlic variety introduced in Pakistan ahead of growing season:

Pakistani scientists have made a breakthrough by developing the highest-yield garlic variety which is suitable for growing in all provinces of the country.

In view of the present demand and yield gap, garlic variety development programme was launched under the vegetable crop research programme at the National Agricultural Research Centre.

The scientists at NARC who participated in this programme say that efforts are being made to make available the garlic seeds to farmers across the country ahead of its growing season which starts in October.

The new garlic variety, `NARC-G1` is the highest garlic variety among all the existing garlic variants in the country. The quality was found to be superior with 26 tonnes yield per hectare.

It has higher nutrient contents and medicinal value with suitability to pharmaceutical, food processing industry and household level. Moreover, farmers' income will also increase due to low expenditure on plant protection and higher yield potential, ultimately reducing the import bill.

This newly-developed variety of garlic was presented at the variety evaluation committee of agricultural research scientists from all over the country at a meeting of Pakistan Agriculture Research Council to determine the potential of this new variant.

Currently, Pakistan is spending precious foreign exchange on the import of garlic due to high demand and low yield of existing varieties. Latest estimates showed that the country is importing 58,040 tonnes of garlic from China, India, and Chile.

The total indigenous production of garlic in the country stands at 74500 metric tonnes from an area of 7,882 hectares with an average yield of 9.6 tonnes per hectare. Khyber-Pakhtunkhwa is the major garlic-producing province with 37.8 tonnes, followed by Punjab (27.4 tonnes), Balochistan (9.2 tonnes) and Sindh (0.1 tonnes).

Source: -[www.Daily Dawn news.com.pk](http://www.DailyDawn.com.pk), July 12th, 2018.

4.3 Province Wise Data of Garlic (1999-2018)

(Area '000' hectares)					
Year	Punjab	Sindh	KPK	Balochistan	Pakistan
1999-00	3	2.6	2.5	0.5	8.6
Avg:	3	2.6	2.5	0.5	8.6
2000-01	2.6	2.4	2.3	0.6	7.9
2001-02	2.6	1.7	2.3	0.4	7
2002-03	2.7	1.8	2.2	0.3	7
2003-04	2.7	2	2	0.2	6.9
2004-05	2.7	1.7	2	0.2	6.6
5-Years' Avg:	2.7	1.9	2.2	0.3	7.1
2005-06	2.8	2	1.9	0.3	7
2006-07	2.9	2.5	2.2	0.2	7.8
2007-08	2.8	2.7	2.4	0.2	8.1
2008-09	2.9	2.8	2	0.7	8.4
2009-10	2.8	1.4	1.9	0.7	6.8
5-Years' Avg:	2.8	2.3	2.1	0.4	7.6
2010-11	3.1	0.9	1.8	0.8	6.6
2011-12	3.1	0.9	1.9	0.8	6.7
2012-13	3.2	1.1	1.9	0.8	7
2013-14	3.2	1.2	2.2	0.9	7.5

2014-15	3.1	1.2	2.8	0.9	8
5-Years' Avg:	3.1	1.1	2.1	0.8	7.2
2015-16	3.1	1.3	2.7	1	8.1
2016-17	3.2	1.3	2.8	1	8.3
2017-18	3.4	0.3	3	1.1	7.8
(Production '000' tons)					
1999-00	31.6	14.6	26.9	3.2	76.3
Avg:	31.6	14.6	26.9	3.2	76.3
2000-01	22.2	12	25.4	4.3	63.9
2001-02	21.1	7.3	24.9	3.2	56.5
2002-03	22.4	8.2	24.6	2.5	57.7
2003-04	22.9	9.7	22.3	1.6	56.5
2004-05	22.7	8.2	22.8	2.2	55.9
5-Years' Avg:	22.3	9.1	24	2.8	58.1
2005-06	22.9	10.4	21.6	2.4	57.3
2006-07	24.1	13	23.5	1.7	62.3
2007-08	23.4	14.3	24.7	1.4	63.8
2008-09	24.9	14.3	22	6	67.2
2009-10	22.3	7.5	21.2	6.3	57.3
5-Years' Avg:	23.5	11.9	22.6	3.6	61.6
2010-11	24.3	4.6	19.5	6.9	55.3

2011-12	25.1	4.5	20.6	7.1	57.3
2012-13	25.6	6.1	21.9	7	60.6
2013-14	25.6	6.5	24.9	7.5	64.5
2014-15	25.1	6.3	34.2	7.5	73.1
5-Years' Avg:	25.1	5.6	24.2	7.2	62.2
2015-16	24.1	6.8	32.2	7.8	70.9
2016-17	25.2	6.8	32.4	8.6	73
2017-18	27.4	0.1	37.8	9.2	74.5

Province wise yield of Garlic in Pakistan:

Year	Punjab	Sindh	KPK	Balochistan	Pakistan
(Yield in tonnes per hectare)					
1999-00	10.5	5.6	10.8	6.4	8.9
Avg:	10.5	5.6	10.8	6.4	8.9
2000-01	8.5	5	11	7.2	8.1
2001-02	8.1	4.3	10.8	8	8.1
2002-03	8.3	4.6	11.2	8.3	8.2
2003-04	8.5	4.9	11.2	8	8.2
2004-05	8.4	4.8	11.4	11	8.5
5-Years' Avg:	8.4	4.7	11.1	8.1	8.2
2005-06	8.2	5.2	11.4	8	8.2
2006-07	8.3	5.2	10.7	8.5	8

2007-08	8.4	5.3	10.3	7	7.9
2008-09	8.6	5.1	11	8.6	8
2009-10	8	5.4	11.2	9	8.4
5-Years' Avg:	8.3	5.2	10.9	8.5	8.1
2010-11	7.8	5.1	10.8	8.6	8.4
2011-12	8.1	5	10.8	8.9	8.6
2012-13	8	5.5	11.5	8.8	8.7
2013-14	8	5.4	11.3	8.3	8.6
2014-15	8.1	5.3	12.2	8.3	9.1
5-Years' Avg:	8	5.3	11.3	8.6	8.7
2015-16	7.8	5.2	11.9	7.8	8.8
2016-17	7.9	5.2	11.6	8.6	8.8
2017-18	8.1	0.3	12.6	8.4	9.6

Source: www.Mnfsr.com

4.3.1 Analysis about Pakistan Area, production and yield of Garlic: -

Production of garlic in Pakistan is 74.5 metric tons from an area of 7882 hectares with an average yield of 9.6 tons/ha (Fruit, Vegetables and Condiment Statistics of Pakistan (FV& CSP) 2017-18). Major garlic producing province is Khyber Pakhtunkhwa (KPK) with an average production of (37.8 tons), followed by Punjab (27.4 tons), Baluchistan (9.2 tons) and Sindh (0.1 tons). Highest yields are obtained in KPK (12.6 tons/ha) followed by Baluchistan (8.4 tons/ha). The yield of top garlic producing countries in the world is China (28.16 tons/ha), Uzbekistan (26.63 tons/ha), Egypt (22.39 tons/ha) while of Pakistan is 9.6 tons/ha which is 3.5 times less than top yielding countries. This yield gap has resulted in the import of garlic from other countries to cater

the demand of garlic in Pakistan. Currently, Pakistan is importing (58,040 tons) of garlic from China, India and Chile of worth about (57,841 US\$) This problem could be resolved by producing high yielding garlic cultivars on the mainland to fulfill the gap between domestic demand and local production.

Keeping in view the economic importance of garlic crop, variety evaluation program was initiated at PARC under Vegetable Crop Research Program during 2000-2001. In 2009-10, during screening & evaluation process, a candidate line appeared with high yield potential which could be better alternate to solve the problem of yield gap/ import. The candidate line was given name “NARC H- G1” which performed better in station, multi-locations/ adaptability and National Uniform Yield Trials (NUYT). The average yield potential of candidate line is 26 tons/hectare which is about two times more than existing cultivated garlic variety “Lehson Gulabi” with shelf life (8-10 months), insect pest tolerance, positive response to fertilizer and varying soil types. Nutritionally, the chemical composition of this candidate line has double Iron, 15% more Magnesium, 74% more copper, less Fat and Ash contents than local variety “Lehson Gulabi”. Hence, this line could be used as value added product for industrial uses to make garlic paste, powder, pickles, sauces and ketchup. Large clove size favors easy peeling and slicing for drying purposes in processing industries and household. In addition, due to its higher nutrient value i.e. Magnesium, Iron and copper; this could be further utilized by the pharmaceutical industry for making their bio fortified products.

To overcome the present yield gap and import burden, yield potential of present candidate line can be materialized for which, there is a dire need to consider the case of candidate line for approval through VEC for better economic returns and in national interest.

4.3.2 Current Problems related to Garlic Production:

- During certain years, garlic crop is attacked by downy mildew disease during the month of February when the weather is cloudy.
- Planting of garlic is very time consuming and expensive.
- High weed infestation.
- Productivity is low.

4.3.3 Future Strategies

- Introduction and selection of high yielding varieties, resistant to diseases.
- Appropriate disease control measures should be determined and applied to garlic crop.
- Suitable planter should be developed for mechanical planting of garlic crop.
- Spacing studies for yield enhancement.
- Use of integrated pest and weed management practices.

4.4 Domestic Consumption Of Garlic

Year	Production (Tonnes)	Add Imports (Tonnes)	Less Exports (Tonnes)	Less Wastage (30% of Total Production) (Tonnes)	Total Consumption (Tonnes)	Total Consumption (K.G's)	Population	Per Capita Consumption (K.G's)
2009	67,200	88,827	206	20,160	135,661	135,661,000	175,500,000	0.77
2010	57,300	54,377	67	17,190	94,420	94,420,000	179,400,000	0.53
2011	55,308	48,313	203	16,592	86,826	86,825,600	183,300,000	0.47
2012	57,365	28,466	919	17,210	67,703	67,702,500	187,300,000	0.36
2013	60,611	47,772	122	18,183	90,078	90,077,700	191,300,000	0.47
2014	64,473	57,846	84	19,342	102,893	102,893,100	195,300,000	0.53
2015	72,987	31,498	317	21,896	82,272	82,271,900	199,400,000	0.41
2016	70,925	51,372	643	21,278	100,377	100,376,500	203,600,000	0.49
2017	73,002	37,070	1,491	21,901	86,680	86,680,400	207,900,000	0.42
2018	75,500	37,575	457	22,650	89,968	89,968,000	212,200,000	0.42

Analysis:

Domestic consumption trends Shows that in 2009, per capita consumption is 0.77kg, and in 2018 per capita consumption is 0.42, the data shows that domestic per capita consumption decreased from 2009 to 2012, while in 2013-14 its consumption is again increased, and then its slightly decreased. Overall in 2009 to 2018 the domestic consumption is decreased from 0.77kg to 0.42kg.

List of Growers is Attached as Annexure 1

4.5 Monthly whole sale prices of garlic in main market:

(Rs./100 kgs.)

Market/ Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan	Feb.	March	April	May	June	Avg.
LAHORE													
2012-13	3504	3222	2651	2490	2451	2251	2627	3096	2667	2472	2264	2270	2664
2013-14	2668	2877	3233	3169	3019	3390	3426	3435	3298	3741	3301	2820	3198
2014-15	2940	3337	3509	3387	3789	4412	4251	4034	4693	4264	3847	3455	3827
2015-16	3804	4087	4081	4300	3757	4618	6224	4824	4612	4802	5257	4698	4589
2016-17	4563	4797	5602	6108	6125	7153	8150	8673	10557	11287	-	6120	7194
HYDERABAD													
2012-13	4500	4800	4860	4600	4000	-	6000	6000	6000	6000	5500	5500	4887
2013-14	4200	3800	-	2400	3600	4400	4000	4600	4400	4400	4000	4000	3982
2014-15	3100	3000	3000	3400	3200	3200	2400	2400	2400	5000	4800	4500	3367
2015-16	9200	9200	7200	5600	5600	4500	-	-	-	-	-	-	6883
2016-17	12600	12600	7200	7200	7200	7200	7200	5600	5600	5600	5600	12800	8033
PESHAWAR													
2012-13	6000	6000	5800	5700	6000	6500	-	-	-	-	-	-	6000
2013-14	4000	4000	4000	4000	5000	5600	5600	4000	4000	4000	4000	4500	4392
2014-15	2800	3200	3200	3200	4000	4000	4000	3600	1600	2400	2200	4000	3183
2015-16	3200	3200	3200	3200	4000	3600	3200	3800	4000	2500	3300	3300	3375
2016-17	4200	4000	4000	4000	4400	8000	6000	4800	4000	3200	4800	4800	4683
QUETTA													
2012-13	4248	-	3248	-	-	-	-	-	-	-	2416	2456	3092
2013-14	2176	-	-	-	-	6160	6400	5920	6800	4512	4224	3104	4912
2014-15	2752	-	2680	2824	-	-	-	-	-	2984	2984	2704	2821
2015-16	3089	2893	3740	3895	4069	3940	4822	4616	4502	4679	4229	4127	4050
2016-17	3803	3944	3830	-	-	-	-	-	7124	6407	4217	4467	4827
MUZAFFARABAD													
2015-16	3200	3800	4800	4600	3800	3500	3500	3600	3200	3200	-	-	3720
2016-17	3800	3600	3200	4800	4600	3800	3500	3500	3000	2800	2800	2600	3500

Source: Provincial Agriculture Marketing Departments

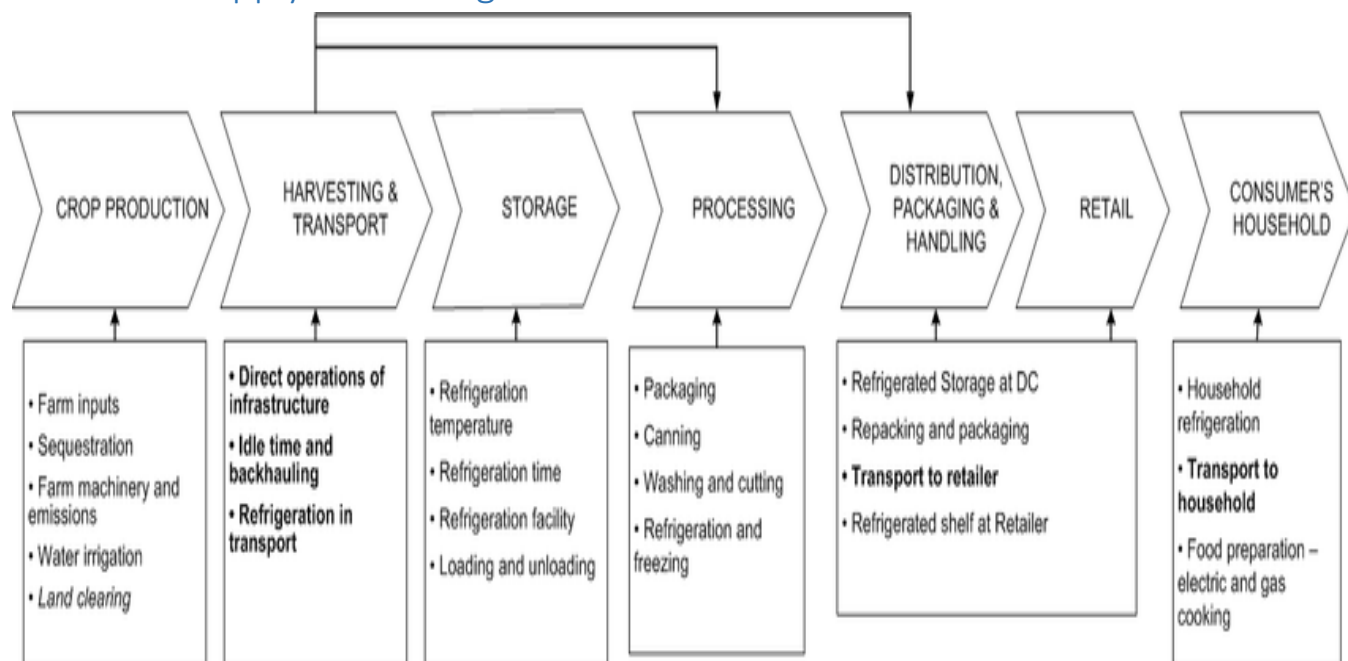
Analysis: The above data of garlic pricing shows that average local market price of garlic has been increasing year by year, though with two way fluctuations also take place. If our research institutes develop good garlic varieties then local production can be increased and prices rationalized. The price difference in different cities is due to product availability in market and different harvesting season of provinces. The prices are lowest at harvesting time during March to April and one to two months after harvesting because product is available in local market. After these months and excess demand prices go on increasing. It shows that critical situation can be managed first by increasing

the production and secondly by enhancing the supply period from supply areas through introduction of early and late varieties.

4.6 COST OF PRODUCTION OF GARLIC CROP FOR THE YEAR 2019-20 UNDER AVERAGE CONDITIONS							
							(Approved)
S.NO	Operations / Inputs	2018-19			2019-20		
		Average No of	Rate /unit	Cost /acre	Average No of	Rate /unit	Cost /acre
		oprs/units/ acre	Rs	Rs	oprs/units/ acre	Rs	Rs
1.	PREPARATORY TILLAGE PLOUGHING						
	1.1 Deep ploughing (Chisel,Disk,Mouldboard)	1.00	1173.00	1173.00	1.00	1255.00	1255.00
	1.2 Ploughing / Cultivator	3.00	517.00	1551.00	3.00	800.00	2400.00
	1.3 Planking	2.00	259.00	518.00	2.00	400.00	800.00
	1.4 Laser Leveling	1.00	586.00	586.00	0.30	1300.00	390.00
	Sub Total			3828.00			4845.00
2.	SEED BED PREPARATION						
	2.1 Bed/Ridge	1.00	856.00	856.00	1.00	933.04	933.00
	2.2 SEED AND SOWING OPERATIONS						
	2.2.1 Seed (Kgs)	180.00	200.00	36000.00	200.00	250.00	50000.00
	2.2.2 Transplanting and Transporting	8.00	525.00	4200.00	8.00	525.00	4200.00
	Sub Total			41056.00			55133.00
3	FRAM YARD MANURE						
	3.1 Farm Yard manure (Trolley)	4.00	1100.00	4400.00	4.00	1100.00	4400.00
	3.2 Transportation Charges	2.00	535.00	1070.00	2.00	583.15	1166.30
	3.3 Labour for spreading Manure (Man days)	4.00	525.00	2100.00	4.00	525.00	2100.00
	Sub Total			7570.00			7666.30
4	FERTILIZERS: (bag)						
	4.1 Urea	1.50	1640.00	2460.00	1.50	1840.00	2760.00
	4.2 DAP	1.00	3350.00	3350.00	1.00	3750.00	3750.00
	4.3 SOP /MOP	1.00	2600.00	2600.00	1.00	3100.00	3100.00
	4.4 Transportation	3.50	19.26	67.41	3.50	20.99	73.48
	4.5 Fertilizer Application (Man days)	1.00	525.00	525.00	1.00	525.00	525.00
	Sub Total			9002.41			10208.48
5	PLANT PROTECTION						
	5.1 Treatments (2 spray)	2.00	550.00	1100.00	2.00	550.00	1100.00
	5.2 Hoeing /Earthing up &Weeding(2*5)	10.00	525.00	5250.00	10.00	525.00	5250.00
	Sub Total			6350.00			6350.00
6	IRRIGATION						
	6.1 Canal Water Rate (Abiana/Acre)			56.30			56.30
	6.2 Cleaning of water courses (M. days)	1.00	525.00	525.00	1.00	525.00	525.00
	6.3 Private Tube well (3Hr/ irrigation)	6.00	1000.00	6000.00	6.00	1000.00	6000.00

	6.4 Labour Charges for Irrigation (M. days)	6.00	525.00	3150.00	6.00	525.00	3150.00
	Sub Total			9731.30			9731.30
7	HARVESTING						
	7.1 Harvesting Handling & Transportation	10.00	525.00	5250.00	10.00	525.00	5250.00
	7.2 Empty Bags.	86.00	12.00	1032.00	87.50	12.00	1050.00
	Sub Total			6282.00			6300.00
8	Land And Rent for 6 Months @ 30,000 PA	6.00	2500.00	15000.00	0.50	30000.00	15000.00
9	Agricultural Income Tax.			48.52			48.52
10	Management Charges for 6 Months of a Manager @ Rs 15,000/15000 PM for 100 Acres	6.00	150.00	900.00	6.00	150.00	900.00
11	GROSS COST (Item 1 to 10)			99768.00			116183.00
12	Yield per Acre (kgs)			3491.0			3500.0
13	Cost per Kg At farm level.			28.6			33.2
14	Cost per 40Kgs At Farm Level .			1143.00			1328.00
15	Marketing Expenses:(Rs /40 Kgs)			34.00			35.00
16	Cost per 40 Kgs At Mandi Gate.			1177.00			1363.00
17	Investment Incentive @25 %			294.00			341.00
18	Indicative Price Recommend			1471.00			1704.00

Section 5: Supply Chain Diagram



5.1 Marketing System of Garlic:

Province	Major producing Areas	Availability in Market
Punjab	Kasur, Sialkot, Gujranwala, Mian Channu, Arifwala, Faisalabad, Jhang	March to April
Sindh	Tando Allah yar, Kunri	March to April
Khyber Pakhtunkhwa	Peshwar, Bannu, Kohat	April to December
Balochistan	Harnai	April to May

5.2 Supply Cycle of Garlic:

SUPPLY CYCLE OF GARLIC			
Punjab	Sindh	KPK	Baluchistan
March-April (33.8%)	February- March (09.9%)	April-December (45.1%)	April-May (11.3%)
0.024 Million Tons	0.007 Million Tons	0.032 Million Tons	0.008 Million Tons
Consumption (Million Tons)			
0.062 (53%)	0.027 (23%)	0.017 (15%)	0.007 (6%)
Surplus / Deficit (Million Tons)			
-0.038	-0.020	+0.015	+0.001
Administrative Unit	Consumption (m. tons)	National Production = 0.071 Million Tons Per Capita Consumption = 0.566 kg/head Consumption = 0.118 Million Tons Gap = 0.047 Million Tons	
FATA	0.003 (2%)		
ICT	0.001 (1%)		

5.3 Grades and Quality Standards of Garlic:

Common Quality

Standard for Garlic Regulations 2288/97

Note: EC2288/97 was published on 19/11/97 and came into force on 1st January 1998 as international marketing standards for garlic.

a) Export grading

I. Definition of produce

This standard applies to garlic of varieties (cultivars) grown from *Allium sativum* L. to be supplied fresh¹

semi-dry² or dry³

to the consumer, garlic for industrial processing being excluded.

II. Provisions concerning quality

The purpose of the standard is to define the quality requirements for garlic at the export control stage, after preparation and packaging.

A. Minimum requirements

In all classes, subject to the special provisions for each class and the tolerances allowed, the bulbs must be:

- sound; produce affected by rotting or deterioration such as to make it unfit for consumption is excluded
- clean and practically free of any visible foreign matter
- practically free from pests
- practically free from damage caused by pests
- firm
- free of damage caused by frost or sun
- free of externally visible sprouts
- free of abnormal external moisture
- free of any foreign smell and/or taste
- to withstand transport and handling
- to arrive in satisfactory condition at the place of destination

Classification: -

Garlic is classified in three classes defined below:

(i) "Extra" Class

Garlic in this class must be of superior quality and characteristic of the variety.

The bulbs must be:

- intact
- of regular shape
- properly cleaned

They must be free from defects with the exception of very slight superficial blemishes, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package.

The cloves must be compact.

The roots must be cut close to the base of the bulb in the case of dry garlic.

(ii) Class I

Garlic in this class must be of good quality. It must be characteristic of the variety and/or commercial type.

The bulbs must be:

- intact
- fairly regular shape

The following slight defects, however may be allowed provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package:

- slight tears in the outer skin of the bulb.
- The cloves must be reasonably compact.

(iii) Class II

This class includes garlic which do not qualify for inclusion in the higher classes but satisfy the minimum requirements specified above.

The following defects may be allowed provided the garlic retains its essential characteristics as regards the quality, the keeping quality and presentation:

- tears in the outer skin or missing parts of the outer skin of the bulb
- healed injuries
- slight bruises
- irregular shape
- up to three cloves missing.

III. Provisions concerning size

Size is determined by the maximum diameter of the equatorial section:

- (i) The minimum diameter is fixed at 45 mm for garlic in the "Extra" Class and at 30 mm for garlic in Classes I and II.
- (ii) In the case of garlic presented loose - with cut stems - or in bunches, the difference in diameter between the smallest and largest bulb in the same package may not exceed:
 - 15 mm when the smallest bulb has a diameter of less than 40 mm.
 - 20 mm when the smallest bulb has a diameter equal to or more than 40 mm.

IV. Provisions concerning tolerances

Tolerances in respect of quality and size shall be allowed in each package, or in each lot for produce presented in bulk, for produce not satisfying the requirements of the class indicated.

A. Quality tolerances

(i) "Extra" Class

5 per cent by weight of bulbs not satisfying the requirements of the class, but meeting those of Class I or, exceptionally, coming within the tolerances of that class.

(ii) Class I

10 percent by weight of bulbs not satisfying the requirements of the class, but meeting those of Class II or, exceptionally, coming within the tolerances of that class.

Within this tolerance not more than 1 per cent by weight of bulbs may have cloves with externally visible sprouts.

(iii) Class II

10 percent by weight of bulbs satisfying neither the requirements of the class nor the minimum requirements, with the exception of produce affected by rotting or damaged by frost or sun, or any other deterioration rendering it unfit for consumption.

Size tolerances

For all classes: 10 per cent by weight of bulbs not satisfying the requirements as regards sizing and the size indicated, but conforming to the size immediately above and/or below that specified.

Within this tolerance, not more than 3 per cent of bulbs may have a diameter smaller than the specified minimum but not less great than 25 mm.

V. Provisions concerning presentation

A. Uniformity

The contents of each package, or lot for produce presented in bulk, must be uniform and contain only garlic of the same origin, variety or commercial type, quality and size (if sized).

The visible part of the contents of the package, or lot for produce presented in bulk, must be representative of the entire contents.

B. Packaging

With the exception of dry garlic presented in strings, which may be transported in bulk (loaded directly into a transport vehicle), garlic must be packed in such a way so as to protect the produce properly.

The materials used inside the package must be new, clean and of a quality such as to avoid causing any external or internal damage to the produce. The use of materials, particularly paper or stamps, bearing trade specifications is allowed provided the printing or labeling has been done with non-toxic ink or glue.

Packages, or lots for produce presented in bulk, must be free of all foreign matter.

C. Presentation

Garlic must be presented as follows:

(i) loose in the package, with cut stems, the length of the stem not to exceed:

- 10 cm in the case of fresh and semi-dry garlic,
- 3 cm in the case of dry garlic

(ii) in bunches by:

- number of bulbs,
- net weight

The stems must be evened off.

(iii) in the case of dry and semi-dry garlic only, in strings by:

- number of bulbs, there being at least six bulbs per string
- net weight.

In the case of presentation in bunches or strings, each package must have uniform characteristics (number of bulbs or net weight).

VI. Provisions concerning marking

Each package must bear the following particulars, in letters grouped on the same side, legibly and indelibly marked, and visible from the outside.

For garlic in strings transported in bulk (loaded directly into a vehicle), these particulars must appear on a document accompanying the goods, and attached in a visible position inside the transport vehicle.

Origin of produce

- Country of origin and, optionally, district where grown, or national, regional or local place name.

Commercial specifications

- Class
- Size (if sized) expressed as minimum and maximum diameters of the bulbs (UN/ECE,1998)

High quality garlic bulbs are clean, white (or other colors typical of the variety), and well cured (dried neck and outer skins). The cloves should be firm to the touch. Cloves from mature bulbs should have a high dry weight and soluble solids content (>35% in both cases). Grades include U.S. No. 1 and unclassified, and are based primarily on external appearance and freedom from defects. Minimum diameter for fresh market is about 4 cm (1.5 inches) (Cantwell, 2006).

Market requirements

Packaging

For bulk marketing the tops of garlic are cut off 1 cm above the bulb and only the loose outer skin rubbed off. Garlic may be made up into strings. These are of 2 kg for garlic. This is, however, a labor-intensive operation suited to small-scale production using family labour.

Duration of storage

On acceptance of a consignment, care must be taken to ensure that the product is dry. Garlic must not be wet or covered with condensation; instead, it must be dry and parchment-like. The stems, the outer bulb skin around the individual garlic cloves must be completely dry. Dry garlic may be kept for 6-7 months at temperature of 0-1° C and 65-70 % R.H.

Ventilation

Garlic requires particular ventilation conditions:

Recommended ventilation conditions: air exchange rate: 25 changes/hour (airing) with continuous supply of fresh air.

Garlic consume large quantities of oxygen due to their metabolic activity and have a tendency to self-heating, it is important to dissipate the CO₂ gas arising during respiration by appropriate ventilation measures and to ensure cooling by supplying fresh air if the cargo becomes heated.

With chilled goods, the fresh air supply must be controlled in such a way that the CO₂ content of the circulating hold/container air does not exceed 0.4 vol. %.

Biotic activity

Garlic display 2nd order biotic activity.

Garlic is a living organ in which respiration processes predominate, because its supply of new nutrients have been cut off by separation from the parent plant.

Care of the cargo during the voyage must be aimed at controlling respiration processes (release of CO₂, water vapor, ethylene and heat) in such a way that the cargo is at the desired stage of ripeness on reaching its destination.

In addition, garlic bulbs must be protected from light during the voyage, as there is otherwise an increased risk of sprouting => in the case of conventional loading, put up awnings if the hatches are opened when at sea.

Gases

Due to the increased intensity of respiration and associated oxygen consumption, garlic has a tendency to self-heating and to elevated CO₂ concentrations in the hold. To counter these

phenomena, particularly extensive ventilation measures are required.

With chilled goods, the fresh air supply must be controlled in such a way that the CO₂ content of the circulating hold/container air does not exceed 0.4 vol.%. The sensitivity of garlic to ethylene is low. The rate of ethylene production is very low, being below 0.1 µl/kg-h

Self-heating / Spontaneous combustion

Oil content: 0.12 - 0.20% essential oils [1], in particular allicin. Allicin breaks down into diallyl disulfide, which produces the pungent garlic odor/flavor. As a consequence of the respiration process in garlic bulbs, a tendency to self-heating, CO₂ concentration and high O₂ consumptions may be observed. Self-heating is associated with losses of essential oils together with sugar and vitamins.

The risk of self-heating is further increased by exposure to excessively high storage temperatures and excessive moisture levels.

Odor

Active behavior -Garlic bulbs exude an unpleasant or pungent odor. An increase in odor intensity may indicate incipient self-heating.

Passive behavior- Garlic bulbs are highly odor-sensitive and should not be stowed together with hides or furs, bones or other animal products.

Contamination

Active behavior- Garlic bulbs may produce dust during loading.

Passive behavior- Garlic bulbs are sensitive to contamination by dirt, fats and oils.

Mechanical influences

Garlic bulbs are sensitive to impact, as they break up easily. It is necessary for garlic to be properly treated in the fields, before it is transported. If in conjunction with high temperature and high moisture levels, garlic is squashed during storage,

Toxicity/Hazards to health

Respiration may cause life-threatening CO₂ concentrations or O₂ shortages. Therefore, before anybody enters the hold/container, it must be ventilated and a gas measurement carried out. The TLV for CO₂ concentration is 0.49 vol.%. Like onions, garlic bulbs consume large amounts of oxygen

Shrinkage/shortage

Evaporation losses and the associated weight loss entail additional losses of essential oils, sugar and vitamins.

Insect infestation/diseases

Garlic bulbs may be infested by rats or mice. This may be the case even prior to loading, a fact which needs to be taken into account on acceptance of a consignment (TIS, 2006).

Post Production operations**Transportation**

Means of transport

Ship, truck, railroad

Not suitable for closed standard containers, as garlic bulbs, like onions, consume large quantities of oxygen and special ventilation measures have therefore to be implemented. Open-sided containers are more suitable, provided that the tarpaulins are rolled up, and wooden dunnage or pallets on the floor of the container improve ventilation. Particular care must be taken on board and at the port of destination to provide adequate weather protection and, where applicable, to roll down the tarpaulins if it starts to rain.

Cargo handling

In damp weather (rain, snow), the cargo must be protected from moisture, since this may lead to self-heating, premature sprouting and root growth

Packing

Fresh market garlic is commonly packaged in cartons, holding 12 display cartons of 1 dozen each; 10-lb cartons holding 12 tube or vexar mesh bags; packages (2-3 bulbs per package);

Storing garlic

Commercially, garlic is stored near 32 °F. However, most home refrigerators are too warm for ideal long-term storage of garlic. Instead, store in a cool, dry, well-ventilated place in well-ventilated containers such as mesh bags. Storage life is 3 to 5 months under cool (60 degree F) dry, dark conditions.

Storing garlic in wine or vinegar. Peeled cloves may be submerged in wine or vinegar and stored in the refrigerator. A dry white or red wine is suggested; white or wine vinegars also work well. The garlic/liquid should be kept for about 4 months in the refrigerator. Discard both the cloves and the liquid if there are signs of mold or yeast growth on the surface of the wine or vinegar. The garlic-flavored liquid and the garlic cloves may be used to flavor dishes.

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5.4 Garlic value-Added Products:

One of the best ways to turn garlic into profits is to make value-added products that will not only enhance its price but also keep it safe until sold.

Growers have several ways to boost their income from garlic by processing the harvested cloves, adding garlic to other products, or creating new value-added products. By taking a few simple additional steps, they can turn their harvested garlic from a simple food item to valuable products that can double, even triple profits.

A list of such product is given below:

- Garlic Powder
- Pickled Garlic
- Garlic Scapes
- Garlic Sauce
- Garlic Vinegars
- Garlic Flakes
- Garlic Chips
- Garlic Enriched Miki Noodles

Scope of Garlic value added products:

Export and value addition in the form of processed products are the important factors for stabilizing prices in internal markets and thereby bringing sustainability in production of certain commodities. To regulate the production and prices it is necessary to develop the dehydration industry in our country. Processing industries in any commodity play an important role in stabilizing prices in domestic markets. Garlic offer very good scope for value addition in the form of dehydrated flakes, powder, sauces, vinegars. Among all these products, dehydrated flakes and powder of Garlic are important from export point of view.

Source: www.Profitable plant digest.com.

5.5 For the garlic supply chain, deficiencies and suggested measure for Improvement:

You may be surprised to know that in Pakistan only one garlic variety which is approved in 1976 in Ayyub Agriculture Research Institute. Since 1976, our Agriculture Research have not been able to offer any new varieties of garlic. that's why our farmers have been filling this gap of garlic crops by its own help, with the result that today the approved variety of Ayyub Agriculture Research Institute has been replaced by a number of unapproved varieties. Especially in Punjab, most of the garlic growers are cultivating unapproved varieties, but now good news is that after long period of 42 years NARC has come up with a new variety of garlic which named as NARC-G1,

- Improve the existing variety to meet the current buyer requirements
- Conduct a soil analysis to establish the existing deficiencies
- Introduce GAP trainings for the farmers
- Create mechanisms for farmer's safer access to inputs
- Review the infrastructural and quality requirements for garlic storage

- Build and strengthen the capacities of farmer groups to offer better services to their members.
- Create a garlic traders' association/platform
- Establish a garlic stakeholders dialogue and knowledge sharing platform

Section 6: Global Trade (Exports/Imports)

6.1 Top Exporters of Garlic by World in Quantity (tons)

Exporters	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
World	1,658,284	1,966,853	1,761,162	1,984,359	2,109,798	2,155,353	1,977,556	2,191,190	2,349,226	2,237,415
China	1,365,187	1,663,984	1,413,651	1,625,938	1,752,100	1,754,166	1,530,649	1,710,476	1,883,862	1,761,649
Spain	65,155	60,354	81,542	98,385	124,475	148,801	162,371	165,785	150,979	183,852
Argentina	89,265	92,059	88,203	71,860	74,918	66,224	77,675	82,974	107,770	98,248
Egypt	3,563	13,242	5,947	6,275	3,536	5,865	14,670	23,040	16,139	36,395
Netherlands	19,774	24,751	23,942	22,013	20,896	32,381	40,797	34,032	36,264	32,084
Iran	2,054	3,639	1,383	3,946	3,832	3,966	2,910	1,325	1,669	17,546
Chile	6,156	10,381	12,110	8,950	10,119	10,622	11,030	11,841	13,820	14,026
Peru	3,695	3,345	5,335	1,728	706	3,864	12,589	13,131	11,082	11,971
France	10,574	12,344	9,839	10,122	9,049	10,069	16,092	12,346	9,055	10,000
Mexico	12,370	12,526	14,245	9,864	4,595	13,459	15,659	14,408	9,201	9,798
India	12,606	2,784	25,436	29,461	16,496	7,278	21,534	33,736	8,839	8,089
Italy	10,512	11,182	11,719	11,978	11,166	10,558	10,017	9,140	9,472	7,731
Malaysia	6,378	5,600	12,605	15,725	20,049	20,719	8,326	18,501	16,390	5,113
U.K	1,536	1,136	1,672	3,371	3,963	5,135	4,593	3,456	3,955	3,630
Uzbekistan								4,049	5,202	3,441
U.S.A	9,505	11,636	6,538	8,449	10,048	9,218	10,113	5,193	3,001	3,068
Korea	52	29	885	405	60	149	11	79	50	1,914
Portugal	275	973	1,154	2,175	1,400	1,756	2,581	2,390	2,035	1,896
Syria	1,814	251	117	373	179	350	752	423	211	1,895
Slovenia	233	99	81	252	646	1,762	600	768	1,435	1,725

Source: ITC calculations based on UN Comtrade Statistics.

6.1.1 Top exporters of Garlic by World in Value (USD thousand):

Exporters	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
World	3,029,083	2,813,587	1,987,913	2,050,040	2,064,159	2,510,620	3,644,279	3,153,958	2,134,580	2,799,173
China	2,318,903	2,068,294	1,387,589	1,397,396	1,473,193	1,861,135	2,645,053	2,185,437	1,411,251	1,991,170
Spain	214,608	195,629	182,730	203,821	221,500	268,771	416,496	355,049	278,381	353,644
Argentina	194,947	207,607	128,409	136,374	107,624	83,524	161,680	182,700	131,945	131,723
Netherlands	58,750	77,557	61,142	59,672	49,691	66,268	117,919	96,097	76,722	78,915
France	46,057	56,773	37,686	42,091	35,572	30,780	43,630	40,968	32,358	32,432
Egypt	6,176	10,659	14,260	7,223	4,748	7,199	15,352	27,226	12,704	28,469
Italy	45,479	54,438	40,365	44,156	35,469	27,998	36,861	33,507	26,914	23,125
Chile	18,696	28,017	22,497	27,854	23,211	27,647	30,704	30,384	21,300	21,600
Peru	4,634	3,281	2,579	1,456	1,269	5,676	19,373	19,919	15,135	17,489
U.S.A	18,768	19,936	11,955	15,366	18,800	16,798	19,460	20,361	15,491	15,714
Iran	1,754	3,252	1,220	4,213	4,172	4,231	2,442	1,311	1,402	15,403
Mexico	12,684	12,908	16,726	11,695	10,564	16,072	21,533	21,256	15,650	15,245
India	19,219	2,610	10,384	11,290	7,603	3,759	19,780	24,263	3,412	6,238
U.K	4,809	2,938	3,796	5,806	7,272	8,943	10,066	8,010	5,968	5,939
Germany	6,760	7,006	4,501	4,662	4,805	3,536	5,265	5,015	3,893	4,496
Malaysia	3,461	3,035	4,453	7,268	7,654	14,982	11,636	23,671	12,980	4,307
Poland	965	420	279	148	301	318	498	1,629	1,962	4,001
Korea	370	222	1,010	764	234	395	129	260	210	3,986
Portugal	593	1,739	2,995	6,412	4,450	4,144	8,552	6,102	4,345	3,607
Denmark	1,329	2,137	2,133	2,757	3,636	3,765	5,230	4,973	3,174	3,445

Source: ITC calculations based on UN comtrade Statistics.

6.1.2 Analysis about World Export of Garlic: -

From the above table of Garlic Export all over the world, we can clearly see that China is main exporter of Garlic over the last ten years. Spain, Argentina, Netherlands are other exporters of Garlic but with much lesser quantities,

China has been promoting garlic as a model export since 2001 and it is the largest exporter and producer of the crop. However, the Garlic market is going through difficulties due to US sanctions and trade conflicts. In the immediate future, unstable pricing and frequent export barriers for Chinese garlic are likely to remain. In addition to china, Iran and India are exporting countries in vicinity of Pakistan

6.1.3 China Dominates Global Garlic Exports

In 2019, the volume of global exports totaled 2,237,415 tonnes, dropping by 7%. In general, the period from 2010 to 2019 was characterized by an upward export trend, although there were some noticeable fluctuations in certain years. After a deep fall in 2010 by 12%, the volume of exports bounced back the following year, only to plummet again in 2012. Afterwards, it recovered through 2013-2014, and then remained unchanged in 2015. In value terms it soared in 2016, driven by price growth amid the curtailed supplies. The rise in prices for garlic began in 2015 and sharply accelerated in 2016. The volume of production in China declined due to the reduction of land under garlic cultivation on the background of unfavorable weather conditions.

China dominates both global garlic production and trade with a share of 77% of the total exports in physical terms. In 2019, China exported 1,761,649 tonnes, which accounted for 7% of its total garlic output. Besides China, the largest global suppliers in 2019 were Spain (183,852 tonnes) and Argentina (98,248 tonnes), all lagging far behind the leader. Spain (+14.6% per year) was the fastest growing supplier, while exports from China expanded at an average annual rate of +0.7%, which resulted from a significant drop of exports in 2019.

6.1.4 World Garlic Exporting Companies: -

According to global trading platform Alibaba, the following suppliers are examples of garlic-trading exporters. The home-country location for each business is shown within parentheses:

- Algo Imports & Exports (United States)
- Amazon Andes Export SAC (Peru)
- Colned Export SL (Spain)
- Dexta Import & Export (Netherlands)
- Green Point for Import and Export (Egypt)
- Jai Commercial Centre (India)
- Jining Optimum Fruits & Vegetables Co (China)
- Laiwu Intop Import & Export Co. Ltd (China)
- Wuhan Lechi Import & export Co. Ltd (China)
- Jining Green Garden International Trade Co. Ltd (China)
- Jining Fenduni Foodstuff Co. Ltd (China)
- Le Vinotier (France)
- Yafod International limited (China)
- Shaanxi King Farmer Eco-Agriculture Co. Ltd (China)
- Jining Glory Foodstuff Co. Ltd (China)
- Qingdao Guang Li Hui Tong Imp & Expo Co. Ltd (China)
- Qingdao Justop Industry and Trade Co. Ltd (China)

6.2 Global Imports:

6.2.1 Top Importers of Garlic by world in Quantity (tons)

Importers	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
World	1,537,033	1,709,837	1,488,189	1,619,598	1,813,691	1,883,321	7,310,047	1,964,462	2,096,149	2,180,296
Indonesia	361,289	419,090	414,958	439,912	491,103	479,941	444,301	556,060	582,994	465,344
Viet Nam	4,170	2,266	No Quantity	4,324	8,390	15,369	12,833	11,156	14,121	227,581
Brazil	153,141	163,623	157,830	176,772	167,232	161,760	173,044	159,257	164,825	165,446
Malaysia	80,751	87,945	91,152	94,977	98,321	115,657	138,548	154,561	151,083	108,553
U.S.A	74,532	72,340	74,668	73,054	80,639	87,555	87,341	89,822	90,132	96,062
Thailand	64,363	69,943	34,309	55,345	56,211	68,431	34,722	41,775	74,986	92,420
Philippines	17,694	7,825	5,765	2,532	29,660	52,361	58,755	66,843	74,698	81,500
Bangladesh	39,766	45,767	22,923	39,616		55,327	33,374	42,902	65,056	81,214
U.A.E			38,685	41,781	46,403	60,666	60,760	66,883	55,852	59,154
Pakistan	54,377	48,313	28,466	47,772	57,846	31,498	51,372	37,070	37,575	58,040
Russia	45,153	58,327	43,899	51,698	52,149	50,678	51,161	53,944	50,963	53,505
Saudi Arabia	33,866	38,621	36,533	38,402	42,893	46,752	45,228	49,475	53,689	50,405
Netherlands	21,754	27,186	30,287	21,682	22,258	34,196	43,676	34,412	33,980	36,151
U.K	25,633	29,481	17,894	21,438	23,863	30,038	33,844	27,977	27,750	32,498
Sri Lanka	20,401	23,755	23,108	11,109	27,012	28,199	30,974	27,488	31,910	31,513
France	23,779	22,712	22,784	22,284	23,369	26,291	27,330	26,273	28,615	26,431
Italy	26,611	29,833	26,541	27,515	27,479	28,995	27,370	24,541	28,272	25,824
Taipei, Chinese	4,562	3,352	2,992	4,638	5,822	2,889	29,228	28,122	11,711	25,679
Colombia	23,728	23,725	29,924	28,418	26,245	21,271	19,826	17,691	26,036	24,351
Germany	19,849	19,975	19,262	19,248	20,939	22,612	24,061	23,887	23,040	22,861

Source: ITC calculations based on UN comtrade Statistics.

6.2.2 Top Importers of Garlic by World in Value (USD thousand):

Importers	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
World	2,121,365	2,156,438	1,688,701	1,968,640	1,829,305	2,151,606	3,042,522	2,861,037	2,123,321	2,753,905
Indonesia	245,960	272,819	242,342	360,858	349,578	342,673	436,088	583,300	497,259	529,965
Viet Nam	5,168	4,868	5,722	6,995	14,401	24,335	31,503	27,090	31,204	307,884
Brazil	251,692	249,394	187,069	219,690	171,518	176,024	328,516	287,528	172,582	225,095
U.S.A	138,760	114,670	152,436	191,072	144,176	182,975	221,559	222,415	163,412	199,811
Malaysia	132,300	93,585	94,544	85,640	79,283	124,290	235,649	187,743	100,484	118,876
Russia	34,083	71,346	57,114	69,921	66,239	68,351	79,087	78,223	67,151	75,854
Bangladesh	53,054	48,819	19,834	34,275		53,297	54,175	41,611	30,883	74,230
Germany	74,587	84,430	66,226	68,414	64,790	62,282	83,569	82,805	71,486	70,022
Netherlands	51,657	63,816	50,535	43,022	39,712	59,768	102,288	81,647	55,374	68,850
U.K	49,248	58,773	37,415	46,441	46,956	54,505	73,080	66,082	54,160	60,874
Pakistan	65,757	59,536	18,496	33,226	45,063	58,629	93,198	68,086	36,073	57,841
U.A.E			43,195	40,385	40,950	70,598	106,828	93,235	32,411	57,637
Italy	85,451	96,299	62,113	68,531	58,097	61,279	80,832	60,402	54,454	54,856
France	78,654	79,381	58,084	61,689	53,672	57,065	76,703	69,702	58,152	54,527
Saudi Arabia	34,130	33,193	32,743	31,105	30,286	40,450	64,580	65,560	36,361	51,752
Japan	40,715	40,505	38,631	34,941	30,828	38,971	54,263	56,218	44,299	48,182
Thailand	13,998	16,815	11,514	15,448	15,264	31,050	24,646	29,007	40,472	46,695
Canada	33,802	33,557	29,278	33,265	33,355	38,132	51,894	48,519	37,528	45,566
Sri Lanka	31,238	21,977	19,057	17,974	18,206	27,296	44,220	35,450	16,655	31,146
Colombia	28,907	22,790	25,508	24,390	21,282	23,050	36,392	24,872	17,551	27,064

Source: ITC calculations based on UN comtrade Statistics.

6.2.3 Analysis about World import of Garlic:

Above table shows that Indonesia is top Importer of Garlic in 2019 and Viet Nam is 2nd largest importer of Garlic in 2019. Brazil is world's 3rd largest importer of Garlic in 2019. Pakistan ranks 10th in terms of quantity of garlic import. and in value terms, it ranks 11th in garlic import.

In 2019, the volume of global imports totaled 2,180,296 tonnes, in general, the period from 2010 to 2019 was characterized by an upward import trend, although there were some noticeable fluctuations in certain years. After a deep fall in 2010, the volume of imports bounced back the following year, Afterwards, it recovered through 2013-2014, and then remained unchanged in 2015. In value terms it soared in 2016, driven by price growth amid the curtailed supplies. The rise in prices for garlic began in 2015 and sharply accelerated in 2016.

Indonesia dominates global garlic imports with a share of 25.5 % of the total imports in terms of quantity. In 2019, Indonesia imported 529,965 tonnes, the other largest global importers in 2019 were Vietnam (307,884 tonnes) and Brazil (225,095 tonnes), all lagging far behind the leader.

The volume of global imports totaled 2,180,296 tonnes in 2019. The imports trend pattern generally mirrored that of exports: these trade flows globally complement each other.

Section 7: Pakistan's Trade of Product

7.1 Pakistan Customs Tariff for Import of Garlic: -

S.No	Description of Goods	Country of Origin	Customs Value(C&F) US\$/KG	Custom Duty
1.	Fresh Garlic	China	1.00	3%
		India via Land route	0.85	
		India via Sea route	1.15	
2.	Dehydrate Garlic Flakes	India via Land route	1.60	
		China	2.25	

Note: - Custom duty is fixed 3% to import garlic from all the countries.

7.1.1 National Tariff:

Description:- GARLIC

PCT CODE:- 0703.2000

Quantity of unit:-KGS

Custom duty@ 3 %

Sales tax@0.00%

Income tax @ 6.00%

IMPORT POLICY:-

1. Import subject to compliance of Phyto-sanitary requirements and drawing of samples and testing of quality by Department of Plant Protection and Federal Seed Certification Agency of Ministry of National Food Security and Research Government of Pakistan.
2. The product not fit for human consumption is banned.
3. Certificate of health fitness for human consumption from Country of Export (origin) is required.

Exemptions:-

- 1)Custom Duty @0% on import of goods Garlic under fifth Schedule to act Custom Act 1969.

<https://tron.pk/page/shipment-inquiry-form/>

7.2 Top Supplying markets of Garlic Imported by Pakistan in Quantity (tons)

Exporters	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
World	54,377	48,313	28,466	47,772	57,846	31,498	51,372	37,070	37,575	58,040
China	49,213	45,495	25,739	36,757	53,254	30,212	48,094	36,774	37,575	48,937
Iran	3							11		7,670
Afghanistan		3								1,383
Malaysia		28	17							33
Egypt							1,067	256		17
Christmas Island					32		27			
Chile				30	32	15		16		
Indonesia							32			
India	5,097	2,788	2,706	1,0922	4,529	1,272	2,130			

Source: ITC calculations based on UN comtrade Statistics.

7.2.1 Top Supplying markets of Garlic Imported by Pakistan in Value (USD thousand):

Exporters	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
World	65,757	59,536	18,496	33,226	45,063	58,629	93,198	68,086	36,073	57,841
China	60,924	54,523	15,779	22,892	40,412	56,713	88,077	67,590	36,073	52,503
Iran	3	0	0	0	0	0	0	18	0	4321
Afghanistan	0	3	0	0	0	0	0	0	0	977
Malaysia	0	36	14	0	0	0	0	0	0	27
Egypt	0	0	0	0	0	0	1,278	422	0	13
Christmas Island	0	0	0	0	18	0	57	0	0	0
Chile	0	0	0	19	20	25	0	30	0	0
Indonesia	0	0	0	0	0	0	56	0	0	0
India	4,754	4,973	2,699	10,275	4,614	1,891	3,692	0	0	0

Source: ITC calculations based on UN comtrade Statistics.

7.2.2 Analysis: -

In order to meet the domestic requirements, Pakistan has been importing significant quantity of garlic every year. The import volume was 54,377 tons in 2010 which reduced to 28466 tons in 2012 and then after fluctuating trend, it reached to 58040 tons in 2019.

China has been the main supplier of Garlic to Pakistan. and its market share has been increased over the period and it has become the sole supplier of garlic to Pakistan in last couple of years. Main reason is that China is world's largest producer of Garlic and our major trading partner. It is easy to access and china is our neighboring country. Earlier Pakistan has also been importing some garlic from India, however it was completely stopped in 2017 onwards. This may due to competitive prices obtained from China or the geo-political relations. However, during 2019, Iran which is one of the producer of garlic in Asia, supplied over 7000 tons of garlic to Pakistan.

7.2.3 Conclusion: As Pakistan is a net importer of garlic, there is not much supply potential for export of garlic to the International market for the time being.

Increase in domestic production of garlic can be achieved by enhancing productivity of garlic crop. Productivity can be accelerated by introducing new technology. In Pakistan the adoption rate of new technology is very slow, therefore improvement in efficiency is an appropriate option to increase the agriculture productivity in short run (Javed et al. 2008). Measurement of the efficiency of agricultural production is an important issue in developing countries. Efficiency was introduced by Farrell (1957), who proposed that the two components, technical and allocative efficiencies, combine together to give a measure of economic efficiency. An effective economic development strategy depends on enhancing productivity and output growth in agricultural sector (Bravo-Ureta & Pinheiro, 1997). Enhanced productivity increases return to the producers as well as to labor and enables larger consumption of goods and services per person (Productivity Commission,)

List of Garlic importers is attached as Annexure 2.

7.3 Top Importing markets of Garlic exported by Pakistan in Quantity(Tons)

Importers	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
World	67	203	919	122	84	317	643	1,491	457	505
United Kingdom	20	44	63	14	67	127	67	288	223	293
Mauritius			21			35	2	46	42	67
United Arab Emirates			51		1		69	438	9	33
United States of America	8	2	7	15	5	87	37	58	38	33
Saudi Arabia	21		7	16	6	10	63	13	8	27
Canada	3	11	32	18	1	35	14	38	13	16
Sri Lanka			329				16	54		11
Bahrain			1	39	1	3	0	3	1	8
Kuwait	1		0		0	3	0	1	1	7
Afghanistan		88	119	18	1	4	5	11	65	3
Qatar			19			2	2	70	40	3
Australia		3		1		1	2	2	14	1
Malaysia			158	1		0	318	442	0	0

Source: ITC calculations based on UN comtrade Statistics.

7.3.1 Top Importing markets of Garlic exported by Pakistan in Value (USD thousand):

Importers	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
World	139	255	900	110	126	466	1,317	2,960	707	982
United Kingdom	60	56	84	11	100	188	137	571	326	492
Mauritius	0	0	21	0	0	66	5	95	83	172
United Arab Emirates	0	0	36	0	2	0	137	1,016	17	72
United States of America	16	3	8	20	7	100	78	123	79	71
Saudi Arabia	32	0	9	19	8	21	120	25	14	67
Canada	7	14	49	18	2	53	27	75	17	35
Sri Lanka	0	0	291	0	0	0	32	139	0	25
Kuwait	1	0	1	0	1	5	1	2	2	14
Bahrain	0	0	2	21	1	6	1	7	2	12
Qatar	0	0	18	0	0	5	4	148	47	7
Afghanistan	0	105	119	18	1	7	10	20	84	6
Australia	0	4	0	1	0	3	4	5	25	2
Malaysia	0	0	139	1	0	1	668	661	1	1
Maldives	2	1	31	0	0	1	0	19	0	1

Sources: ITC calculations based on UN comtrade Statistics.

7.3.2 Analysis about Garlic Export by Pakistan: -

Through Pakistan is regular importer of garlic, it has also been exporting garlic in small quantities. From the above table of Garlic export by Pakistan, we can see that Export of garlic has been experiencing a fluctuating trend over last ten years. In 2010, Pakistan exported only 67 tons' garlic, which jumped to 919 tons in 2012 and then went down. It again recorded abnormal increase in 2016 and when export of garlic reached 643 and 1491 tons respectively. The interesting point noted is that in all three years where export jumped abnormally, garlic was exported to Malaysia. Almost similar trend was noted in export value over the past. We export garlic fresh and in value added products, such as Garlic ketchup in sachets, Garlic Powder, Garlic Flakes, Garlic Vinegars etc. Export prices of garlic also experiencing the fluctuating trend over the last ten years. In 2010 Pakistan export in value terms is 139 USD garlic, which jumped to 900 USD in 2012 and then went down. It again increases in 2016 and 2017 and export value is 1,317 USD and 2,960 USD respectively.

7.3.3 Comparison of garlic imported by Pakistan versus locally produced garlic:

Per kg cost of garlic imported by Pakistan in 2019 is Rs 170, while domestic cost of production in 2019 is Rs 33 per Kg, so we can conclude that domestic produced garlic is cheaper than garlic imported by Pakistan.

7.3.4 Exports of Garlic from Pakistan: Exports of Horticulture products especially Garlic are the need of the day of Pakistani farmers (growers). Being in the stage of infancy the target quality and quantity cannot be achieved unless modern ways and means are adopted along with the provision of basic infrastructure. This will include expertise technical advice on production, post-

harvest techniques, legal and financial marketing aspects, adequate cool room capacity, reliable supplies of quality planting stock, contact supplies of packing material, post-harvest disinfection facilities (for pest control), refrigerated transport to markets, reliable freight forwarders, reliable specialist exporters. This will be additional to capital (large amount is required to run the business), market search (to exploit sale opportunity) and the scientific data (to explore the suitability of varieties to certain situation and regions). These modern ways and means of production and marketing will ensure quality production and proper utilization of produce up to the end consumer.

7.3.5 Problems

- Major problem hindering the exports are post-harvest treatments.
- Lack of knowledge of markets.
- Absence of modern marketing techniques.
- Casualness about standardization and quality controls.
- Lack of shipping and air cargo facilities.
- High freight rates
- Lack of proper control of diseases and pests.
- Government needs to strengthen the infrastructure facilities for the treatment, transportation and storage of horticulture products for export. It needs to work with the existing Agencies in providing the much needed support to their work in their areas given the perishable nature of product, long transit time.

7.3.6 Export constraints:

Pakistan's export of horticulture product is not encouraging. The low performance is attributed to many constraints like:

- Non availability of air space in major airlines, since most of the airlines operators prefer heavy consignment.
- The existing numbers of flights during the peak seasons is not sufficient for export purpose.
- Exporters face infrastructural problem like bad interior road, inadequate refrigerated transport and storage facilities.
- Lack of professional backup of delivery and supporting companies, which resort to high cost of technology.

7.3.7 Solution of these problems:

In order to overcome these problems, attention must be focused on:

- Reduction in import duty on planting material and equipment.

- Sufficient cargo space may be provided in airlines.
- Establishment of model nurseries for supplying genuine planting material.
- Training centers for diploma course for training the personnel in horticulture should be setup.
- Exporters should be plan and monitors effective quality control measures right from production to post harvesting, storage and transportation.

List of Import and Export companies of Garlic with Addresses and Contact details:

1) **Insta Food Industries Pvt Ltd:**

It deals in import and export of Dehydrated garlic and potatoes and their products,
Telephone:92-333-480-8880, Address: Lahore, Punjab, Pakistan.

2) **Lakha Associates:**

This company is based in Karachi, and it is a member of Tradekey.com since January 2011,
It deals in garlic, onion, and potato.

Telephone:92-333-206-5451, Address: Super High way, Karachi, Sindh, Pakistan.

3) **Biz Knock Enterprises:**

It is Pakistan based import and export company of Multi-Products such as garlic, ginger, onion and potatoes.

Telephone:0092-21-252 8339,03332371682. Address: Raja Manzil, Street No. G-14, Noorani Masjid Road, Layari Town, Karachi.

4) **Munaf International Import and Export Company:**

It deals in import, export and processing of spices and condiments like garlic, ginger, onion.

Telephone:92-21-37070296,021-5067494-95 Address: Korangi Industrial Area, Karachi, Pakistan.

5) **Across Asia Intl.Co.(Pvt) Ltd:**

It deals with all kind of import and exports, specially fruits and vegetables products and spices including garlic.

Telephone: 92-42-37045533, Address: Dry Port Road, Chaklala, Rawalpindi, Punjab, Pakistan.

6) **Tradbiz International:**

It deals in import and export of Multi-products, including garlic.

Telephone:92-300-6863678, Address: Gulshan-Iqbal, Karachi, Pakistan.

7) **Raz Corporation:**

It deals in import and export of fresh fruits, vegetables and spices including garlic.

Telephone:92-213-2627831,03003389172. Address: 1st Floor, Mandviwala Bldg., Shahr-ah e Liaquat, Karachi, Pakistan.

8) **Taheri International:**

It deals in export of garlic and ginger paste, dates and rock salt.

Telephone:92-331-2656272, Korangi Industrial Area, Karachi, Pakistan.

9) **Hyderabadi Daccan Food Pvt Ltd:**

The most popular name for food products in Pakistan is probably Hyderabadi Daccan Food.

It deals in import and export of garlic, ginger, sauces and jams.

Telephone:92-3333518007, Address: Hyderabad Colony, Karachi, Pakistan.

10) **FTP Food Technologies Pakistan:**

It deals in manufacture and import, export of different food products including garlic.

Telephone:92-3002435403, Address: Layari, Karachi, Pakistan.

11) **Bharamchari International:**

It deals with imports of fresh garlic and ginger.

Telephone:092-021-4915500, Address: Ghousia Apartments, Fatima Colony, Jamshed Road, Karachi.

12) Bravo International:

It deals in import & export business of garlic, ginger, red kidney beans, and apple.

Telephone: 92-51-447-1083, Address: B-III,872 Khurram colony, Muslim Town, Lahore.

13) Sohail Haroon Corporation Pvt Ltd:

It is basically an Agriculture based Company that deal with export, import and whole sale of Fruits and vegetables to different parts of world,

Telephone: 92-322-2708549, Address: A-193, Block 19, Gulshan Iqbal, Karachi.

14) R.B.L International:

It is Manufacturer, Processor & Exporter of Consumer food products, it exports garlic paste, fried onion, green chili spices, and dehydrated products.

Telephone: 0092-021-2436363,03009250004. Address: Jodia bazar, Karachi, Pakistan.

15) Overseas Trading Services:

It deals in import & export of agricultural products. Main importers of garlic, ginger, dried fruit, and grains.

Telephone: 92-42-5784004. Address: Suite 9, 2nd Floor, Leeds Centre, Main Boulevard, Gulberg, Lahore.

16) F.I. General Trading Company:

It deals in imports of garlic, ginger, and dried fruits.

Telephone: 92-322-4893402, Address: H 113, Iftikhar Street, Qaddafi Road, Muslim Park, Ichra, Lahore.

17) All Fresh:

It deals with import & export of fresh fruits, vegetables and spices, including garlic.

Telephone: 92-321-900-2170, Address: Gulbahar town, Street No 3, Peshawar.

18) Adnan Enterprises:

It is leading company of Pakistan in importing and exporting fresh vegetables, and spices, (garlic, ginger, onion and potato).

Telephone: 92-21-6870111,03333325028 Address: New Sabzi Mandi, Super High way, Karachi.

Section 8: SWOT Analysis

8.1 Issues Related to Garlic:

Pakistan is a country of small farming households, where, Horticulture is the best option of enhancing the income of the under privileged. Introduction to the Garlic crop could be an important intervention in this regard where the farmer can earn much more by exploiting available natural resources more efficiently. We have favorable climate and cheap labor for growing garlic crop whereas they need much less land and water for production. The crop also gives the premium prices almost round the year and there is no need to wait for a long time as in the case of other routine crops. Garlic are in high demand all over the world. But in Pakistan, Garlic crop is in its embryonic stage. There are lack of resources and skilled persons to develop the Garlic crop up to international standard. It is need of the time to produce skilled persons and explore new means to ensure survival of our farmer and explore marketing to save our economy as well as increase our exports.

8.1.1 Some of the problems faced by the Garlic producer in Pakistan:

- It is difficulty of a farmer to obtain quality plants in the desired variety.
- Appropriate facilities for harvest and post-harvest management are unavailable.
- Imbalance fertilizer application by farmers adversely affects its production.
- Low productivity, high cost of production and lack of awareness about high yielding variety are the main factors which restrict farmers to cultivate garlic in Pakistan.
- High percentage of post-harvest losses
- Inadequate storage facilities and conventional methods used in processing/packing
- Inadequate market information (local/international)
- Lack of irrigation facilities (drip/sprinkler etc.)
- Non availability of cold chain storage facilities
- Lack of appropriate packaging for Garlic produce.
- Lack of well-established information database.
- Lack of infrastructure to support the technology development, education and training.

8.1.2 Opportunities:

- Continued support for the expansion and development of the bulb sectors of the industry.
- Encouraging and supporting the formation of Garlic bulb certification scheme, particularly for exports.
- Promoting opportunity for the development of native Garlic varieties for the domestic and export markets.

- Identification of market niches that can be supplied taking advantage of Pakistan's climate.
- Increase the networking ability of the industry and the work with key grower groups to increase their market access.
- Increase the industry's access to skill based training schemes.

8.1.3 Challenges:

- With some popular Garlic types oversupplied in the international markets, ensuring the quality and quantity of products will be important to maintain market share and development of export opportunity.
- Increasing national coordination of the industry to maximize the effectiveness of marketing promotion in export market.
- Ensuring the availability of skilled labour during harvesting. Processing is labour intensive and vital for the product quality.

8.1.4 Import Substitution Strategy:

- The first essential part of the strategy is to identify areas for investment in growing areas, which can cater to domestic needs that are currently being met by imports.
- This is necessary to reduce external vulnerability that is resulting in a chronic balance-of-payments crisis.
- Import substitution requires domestic investment and local technology.

8.1.5 Step up for Garlic Production – better late than never:

- By now, the time has come to rethink strategies for uplifting the garlic production and make concerted efforts to develop them in line with international best practices.
- However, such a rethink would require all the stakeholders to be on the same wave length.
- On its part, Govt should offer progressive farmers needs to come up with ideas to develop effective models farm for garlic production.
- Moreover, it should also establish platforms to promote Pakistani brands across the globe. Such stimuli would boost confidence of the farmers and encourage them to invest in these crop.
- Farmers should utilize platforms of national organizations like NARC and PHDEC to effectively promote and flourish their businesses.

8.1.6 Matrix of Garlic Problems and Possible Solutions:

Sr.No.	Problem	Proposed Solution	By whom
1	Low and stagnating yield of garlic	<ul style="list-style-type: none">• New high yielding varieties• Expansion of production period• Improvement in farm management	Research Extension
2	Heavy price fluctuations	<ul style="list-style-type: none">• Timely release of area and production estimation• Collection and dissemination of market information• Price forecasting	Crop Reporting Service Agriculture marketing
3	Lack of value addition	<ul style="list-style-type: none">• Introduction of new advanced technique suitable for processing like dehydration etc.• Introduction of new cultivars based on targeted local and international market	Food Technology Research

Annexure 1: List of Growers of Garlic

S. No	Name	Mobile Number	Area
1	Muhammad Ishaq	0304-8101835	2 kanal
2	Muhammad Yaseen	0300-7925001	2 Kanal
3	Farooq Ahmad	0303-4749269	2 kanal
4	Allah Jawaya	0303-7956267	1kanal
5	Nazeer Ahmad	0304-8109490	1kanal
6	Saeed Ahmad	0300-8071691	1kanal
7	Naseer Ahmad	0300-0221077	1kanal
8	Muhammad Mehmood	0308-5831759	1kanal
9	Muhammad Ramzan	0300-7545154	2 kanal
10	Tariq Hassan	0300-7543900	1 kanal
11	Zahoor Ahmad Gujjar		1kanal
12	Muhammad Ramzan	0302-9758159	2 kanal
13	Muhammad Saeed Khan	0300-6985023	1kanal
14	Abdul Sattar s/o Sardar Muhammad	0345-7045471	1kanal
15	Nazir Ahmad	0333-6399602	1kanal
16	Abdul Qayome	0334-7001971	1kanal
17	Shahzad Makbool	0333-6329248	1kanal
18	Muhammad Amin	3427150290	2 kanal
19	Faisal Munir	3066841659	1kanal
20	Muhammad Arshad	3458579282	2 kanal
21	Munir Hussain	3069583877	3 kanal
22	M.Junaid	3078282900	2 kanal
23	Abdul Razzaq	3476414408	1kanal
24	Shairzullah	3027578580	1kanal
25	Ryasat Ali s/o Muhammad Ameen	0301-3018820	2 kanal
26	Sohail	0305-7979773	1kanal
27	Asif	0304-8273023	4 kanal
28	Muhammad Basheer	0304-9656963	2 kanal
29	Haji Muhammad Nawz	0301-7369410	4 kanal
30	Fazal Rehman s/o Imdad	0334-7580575	4 kanal
31	Khushi Muhammad	—	2 kanal
32	Muhammad Abbas	0300-4910574	2 kanal
33	Muhammad Ahmad	0306-7869401	4 kanal
34	Sheer	0300-8179507	2 kanal
35	Ijaz	0306-5317950	3 kanal
36	Muhammad Younas	0303-3149222	2 kanal
37	Muhammad Sadiq	0302-3890626	2 kanal

38	Faiz Ahmad	0305-6742240	4 kanal
39	Ghulam Fareed	0301-6255653	3 kanal
40	Ghulam Murtaza	0300-3932138	2 kanal
41	Mehmood	—	1kanal
42	Muhammad Aslam	—	2 kanal
43	Habib Ullah	0306-5566200	3 kanal
44	Muhammad Abbas	0306-4919212	2 kanal
45	Muhammad Yar	0306-7684919	1kanal
46	Muhammad Irashad	0300-0832549	4 kanal
47	Muhammad Niaz	0301-6857699	4 kanal
48	Shoaqat Ali	0301-6349619	4 kanal
49	Abid Hussain	0302-4375615	4 kanal
50	Muhammad Sultan	0346-6890375	2 kanal
51	Ameer Baksh	-	1kanal
52	Muhammad Amir	-	1kanal
53	Abdul Qayome	-	1kanal
54	Fiaz Ahmad	0306-0269395	1kanal
55	Yasor Mehmood	0303-7777104	1kanal
56	Muhammad Aslam	0321-6985668	1kanal
57	Muhammad yousuf	0308-7198123	2 kanal
58	Ayub Ur Rehman	0300-8770566	1kanal
59	Zahid Ali Shah	0346-5707425	4 kanal
60	Aurangzeb	0312-9236178	4 kanal
61	Ishfaq	0333-3632029	01 Acre
62	Waqas Ahmed	0300-5606632	01 Acre
63	Sadaqat	0313-8357596	1 Acre
64	Malik Aslam	0333-5322786	15 Kanal
65	Musarrat Khan	0333-9033327	3 Kanal
66	Malik Aftab	0311-5337612	2 kanal
67	Ghulam zaid	0321-5726538	2 kanal
68	Muhammad younus	0311-5812709	2 Kanal
69	Waheed Ahmed	0321-5711171	2 Kanal
70	Rehmat Illahi	0321-5604323	3 kanal
71	Ahmed Khan	0321-5745973	2 Kanal
72	Ahmed Nawaz	0305-8691029	1 kanal
73	Ashraf	0312-5406301	2 Kanal
74	Muhammad Khan	0321-5709188	3 Kanal
75	Luqman Shah	Nil	4 kanal
76	Asif	0346-5916490	4 kanal
77	Arshad Khan	0312-5304800	8 kanal

78	Daim Khan	0300-5495422	2 kanal
79	Altaf Khan	0321-5246952	2 kanal
80	Fazal Qadir Khan	0343-9098758	4 Kanal
81	Shafqat Khan	0321-5283646	4 kanal
82	Zumrad khan	0312-0107236	6 Kanal
83	Riasat Khan	0322-5713467	4 kanal
84	Mubassir Shah	0314-5121018	2 kanal
85	Khanzada	0345-5809088	4 kanal
86	Saif ul Malook Khan	0315-5701047	6 kanal
87	Daood Khan	0321-9843765	2 kanal
88	Malik Umair	0313-5080515	8 kanal
89	Azam Khan	0321-5750204	4 kanal
90	Taj Khan	0314-4115038	4 Kanal
91	Khan Afsar	0343-5657437	2 kanal
92	Ishaq Khan	0301-5174575	1 Acre
93	Izaz Khan	0333-2335800	2 Kanal
94	Taj Wali	0343-5431615	4 kanal
95	Muhammad Din	0313-9073003	1 kanal
96	Ahmed Ali Shah	0347-6744192	2 kanal
97	Muhammad Islam	0345-5809325	2 kanal
98	Muhammad Iqbal	0313-0593431	2 Kanal
99	Amjad Mehmod	0346-7459408	2 Kanal
100	Habib Khan	0342-5090288	2 Kanal
101	Malik Mubassir Ali	0345-5980646	1 Acre
102	Malik Arif Khan	0345-5872549	1 Acre
103	Azhar Ali	0346-7269511	1 Acre
104	Asad Ali Khan	0345-5232714	1 Acre
105	Saqib Mehmood Khan	0345-5807220	2 Acre
106	Tahir Mehmood	0345-5808631	0.5 Acre
107	Haji Afzal	0345-5288892	10 Acre
108	Rahmat Ali	0345-5524492	04 Acre
109	Jawad Ahmed	0315-5472911	1 Acre
110	Azhar Iqbal	0344-5199063	5 Acre
111	Amjad Ali	0307-5449931	10 Acre
112	Ibrar Ali	0343-5537228	5 Acre
113	Mehran Khan	0313-5296887	5 Acre
114	Adnan Sajjad	0303-5835090	5 Acre
115	Kamal Haider	0315-5472911	1 Acre
116	Azhar Khan	0311-5184080	9 Kanal

117	Nawzish Khan	0313-1510908	5 kanal
118	Naseer Ahmed	0311-5273198	6 kanal
119	Nawab Khan	0313-5361040	9 Kanal
120	Sarfaz Khan	0311-5082505	5 kanal
121	Maqsood Ahmed	0346-5307068	8 kanl
122	Muhammad Bilal	0346-5937365	8 kanl
123	Hafeez Akhrtar	0344-5814672	11 kanal
124	Iftihar Ahmed	0346-4076887	11 kanal
125	Ijaz Ahmed	0346-5716512	10 kanal
126	Zaid Ali	0346-5701850	3 Kanal
127	sajid Khan	0344-9549841	4 kanal
128	Zafar Ali	0315-0009352	1 kanal
129	Rafaqat Ali	0312-5483427	4 kanal
130	Niazi Khan	0311-0923379	2 Kanal
131	Saeed Ahmed	034-7-0105620	4 kanal
132	Waheed Ahmed	0345-5621037	4 kanal
133	Asif Khan	0345-5809085	4 kanal
134	Rehmat Ali	0345-5809085	2 Kanal
135	Zabat Khan	0343-5654933	3 Kanal
136	Azhar Ali	0311-5630072	3 Kanal
137	Nisar Ahmed	0342-5527292	2 kanal
138	sabzada Khan	0312-9559357	4 kanal
139	Ijaz Ahmed	0345-5411600	4 Kanal
140	Tahir Khan	0343-5430223	3 Kanal
141	Khalid Khan	0311-5195550	3 Kanal
142	Shaukat Khan	0308-5076008	2 Kanal
143	Asif Ali	0300-5868255	2 Kanal
144	Wajib Khan	0346-2394071	2 Kanal
145	Asif Mehmood	3335062000	1kanal
146	Fazal Qadar	3025467975	1kanal
147	Muhammad Javed	3100506298	1kanal
148	Jahangeer Iqbal	3015489817	1kanal
149	Israr ul Haq	3455621501	1kanal
150	Faqeer Khan	3334274088	1kanal
151	Aftab Ali	3225800680	1kanal
152	Umer Hayyat	306268820	1kanal
153	Ameer Khan	3215139129	1kanal
154	Mazhar Jamil	3005314711	1kanal
155	Qasir	3238541300	1kanal

156	Abdul Razaq	3015315887	1kanal
157	Tariq	3075245900	1kanal
158	Fazal	3315273411	2 kanal
159	Israr ul Haq	3455621501	2 kanal
160	Parvez Akhtar	3235392826	2 kanal
161	Ijaz Ahmed	3446230160	1kanal
162	Zulfaqar Khan	3035266124	1kanal
163	Rafaqat	3014129617	1kanal
164	Ayoub	3135239260	1kanal
165	Fazal Qadar	3025467975	1kanal
166	Nasar	3465707265	1kanal
167	Tanveer Hussain	3235702471	2 kanal
168	Amjad Mehmood	3233319698	1 kanal
169	Sabir Mehmood	3005606687	1kanal
170	M. Dawood	3245030924	1kanal
171	Arshad	3009199965	1kanal
172	Abdul Razaq	3345371081	1kanal
173	M. Nawaz	3315218653	1kanal
174	Gulam Fareed	3009817560	1kanal
175	Abdul Rasheed	3027788706	2 kanal
176	Pervaz	3235392826	1kanal
177	Hanif	3325402380	1kanal
178	Sadiq	3325062000	2 kanal
179	Mehboob	3005498271	1kanal
180	Rifaqat	3225018819	1kanal
181	Asif Mehmood	3335062000	1kanal
182	Muhammad Waqas	3245113131	1kanal
183	M. Riaz	03365686744	1kanal
184	Abdul Jabbar	0308-5277055	1kanal
185	Adil Iqbal	0312-9945565	1kanal
186	Rab Nawaz	0312-5012941	1kanal
187	Rafaqat ali	0302-5374735	1kanal
188	M. Shoaib	0311-5534570	1kanal
189	Abdul Qudoos	0313-5248336	1kanal
190	Amjad Pervaiz	0315-9830986	3 Kanal
191	Zubair Khan	0300-5601042	1kanal
192	Shoukat ali	0310-9276613	4 Kanal
193	Kamran ali	0333-5234714	4 Kanal
194	Uzair	03225296001	1kanal
195	Yasir Mehmood	0341-5453837	1 Acre

196	Aamir Hussain	0312-0869125	1 Acre
197	Aamir Hayat	0313-5128699	1 Acre
198	Muhammad Arshad	0313-5107119	1 Acre
199	Ansar Hayat	0306-5452434	1 Acre
200	Muhammad Waqas	0305-6054720	1 Acre
201	Irfan Akhtar	0331-5666448	1 Acre
202	M. Yaqoob	0310-5591541	1 Acre
203	Noor Ul Haq		1 kanal
204	Jahangir Khan	0301-5437854	1 kanal
205	Irfan	0345-5973058	1 kanal
206	Ghulam Shabir	0300-9138629	1 kanal
207	M. Pervez	0314-5224231	2 kanal
208	Aashiq Hussain	0342-9559980	4 Kanal
209	Imdad Hussain	0315-5201500	1 kanal
210	Noor Muhammad	0314-5228614	1 kanal
211	M. Shoiab	0306-5608816	1 kanal
212	Muhammad bashir	3015555330	1 kanal
213	Muhammad faisal	3465770614	4 Kanal
214	Mehdi Shah	3413363830	4 Kanal
215	Hashim Ali Khan	3455152738	1 kanal
216	Ameer Sultan	3035085093	3 acre
217	Muhammad Amir wahid	3076393365	1 acre
218	Muhammad Hayat	3335782200	1 acre
219	Muhammad Farooq	3319551939	0.5 acre
220	Muhammad Sultan	3235928681	2 acre
221	Muhammad Khan	3215462195	0.5 acre
222	Ch Gazanfar Ali Khan	3135475456	1 acre
223	M. waqas	0341-3877222	1 kanal
224	M. naveed	0334-9777333	2 kanal
225	Ghullam Sarwar	0340-0109585	1 kanal
226	Meer Alam	0346-5978408	4 Kanal
227	Muhammad Nadeem	333-9550256	1 kanal
228	Raja Gul Jabbar	0307-8903286	2 kanal
229	Zafar Iqbal	0300-8560025	1 kanal
230	Rashid Kiani	0333-5547300	1 kanal
231	Raja ishtiaq	Nil	1 kanal
232	Shahid mehmod	0332-9971673	1 kanal
233	Muhammad Nawaz	0321-8534917	1 kanal
234	Muhammad Aslam		1 k
235	Muhammad Zafar		1 kanal

236	Mazhar so Shahbaz		
237	Irfan	0342-6251550	1 kanal
238	Afzal	0304-4548322	1 kanal
239	Mahmood	0300-8752651	1 kanal
240	Rafiq	0301-4950698	1 kanal
241	Muhammad Lal	0302-3714651	1 kanal
242	Muhammad Aslam	0304-9127051	1 kanal
243	Muhammad Adnan so Sardar	0315-4850151	1 kanal
244	Muhammad Nawaz	0301-6582536	1 kanal
245	Mazhar	0301-6582596	3 Kanal
246	Muhammad Shafiq	0301-72516481	1 kanal
247	Muhammad Rafiq so Hasham	0343-8642651	1 kanal
248	Niaz Ahmad	0304-7952928	1 kanal
249	Muhammad Usman	0300-8752651	3 Kanal
250	Manzoor Ahmad	0344-6960060	1 kanal
251	Umar Jabar	0307-6749110	3 Kanal
252	Muhammad Asif	0301-4952203	1 kanal
253	Taj Muhammad	0301-7894623	2 kanal
254	Muhammad Sajad	0345-4900053	3 Kanal
255	Barak Ali	0321-9645209	3 Kanal
256	Muhammad Nasir	0343-5386135	4 Kanal
257	Abdul Rasheed	0307-7545507	1 kanal
258	Muhammad Iqbal	0301-5594509	1 kanal
259	M Aasim	0300-6977231	3 Kanal
260	Ahmed Ali	0301-7445104	3 Kanal
261	Abdul Rehamn	0301-4668229	4 Kanal
262	Asif Hussain Shah	0306-5110966	4 Kanal
263	Tauqeer Hussain	0304-7957657	4 Kanal
264	Subah Sadiq	0302-9413210	1 kanal
265	Iqbal Masood Khan	0300-7689405	3 Kanal
266	Ch Mudassar Akbar	0305-7398999	1 kanal
267	Khursheed Wattu	0321-6532877	1 kanal
268	Muhammad Altaf	0308-9044060	3 Kanal
269	Muhammad Mustaque	0343-7804575	3 Kanal
270	Ghulam Mustafa	0345-7113547	3 Kanal
271	Muhammad Tariq	0305-7398100	1 kanal
272	Ch. Altaf Hussain	0305-9211744	1 kanal
273	Muhammad Shahzad	0300-6940297	1 kanal
274	Muhammad Tariq	0303-5673107	1 kanal
275	Liaqat Ali	0345-7424976	1 kanal

276	Abid Ali	0303-2325220	1 kanal
277	Abdul Majid	0300-6925530	1 kanal
278	Muhammad Ashraf	0346-7400200	1 kanal
279	Ghulam Muhiul Din	0305-6725250	1 kanal
280	Muhammad Sharif	0302-9293250	1 kanal
281	Muhammad Sajjad	0300-2520932	1 kanal
282	Malik Mushtaq	0309-8785230	1 kanal
283	Peer Iqbal	0307-2130049	1 kanal
284	Manzoor Ahmad	0305-2323250	3 Kanal
285	Muhammad Mossa	0300-7685250	4 Kanal
286	Anwar-UL-Haq	0306-6922020	2 kanal
287	Javid Iqbal	0305-6598509	2 kanal
288	Haji Altaf	0308-6369320	1 kanal
289	Azizurehman	0308-6854893	1 kanal
290	Bashir Ahmad	0343-2452651	1 kanal
291	Fakhar Abbas	0346-7424976	1 kanal
292	Sabir Hussain	0346-7461081	1 kanal
293	Abdul Kahliq	0345-7423773	3 Kanal
294	Amanit Ali	0348-4738106	1 kanal
295	Muhammad Yaseen	0348-4154377	1 kanal
296	Muhammad Yaseen	0346-6433580	1 kanal
297	Muhammad Asif	-	1 kanal
298	Muhammad Tahir	-	1 kanal
299	Sadiq	-	1 kanal
300	Noor Muhammad	-	1 kanal
301	Muhammad bilal	-	3 Kanal
302	Mian Naeem watoo	-	1 kanal
303	M.Fiaz Ahmad	-	1 kanal
304	Muhammad Jahngir	3126044016	3 kanal
305	Sadi Ahmad	0333-7070189	6 Kanal
306	Arif Hussaink	0305-6236158	2 Kanal
307	Riyasat Ali	0345-4107590	5 Marla
308	Muhammad Latif	0342-8679990	4 marla
309	Muhammad Nawaz	0345-4708478	2 marla
310	Muhammad Saddique	0345-4708478	2 marla
311	Muhammad Akram	0301-6959191	2 marla
312	Muhammad Akhtar	0308-9046052	2 kanal
313	Jamil Akhtar	0345-7291025	2 marla
314	Imtiaz Ahmad	0343-6742150	5 marla
315	Abdul Khaliq	0344-4520400	2 marla
316	Zeeshan Mustaf	0345-4913393	3 marla

317	Sabir Ali	0340-6791603	2 kanal
318	Master Riaz Ahmad	0342-6749290	1 kanal
319	Munir Ahmad	0342-4075430	1 kanal
320	Umar Daraz	0341-4519218	1 kanal
321	Muhammad Tufail	0343-4750677	1 kanal
322	Muhammad Javaid	0333-4773808	2 kanal
323	Muhammad Irfan	0346-7413875	1 kanal
324	Shoukat Ali	0343-6741886	4 Kanal
325	Muhammad Ajmal	0343-6676375	2 kanal
326	Zafar Iqbal	0342-6611054	2 kanal
327	Muhammad Hussain	0344-4323209	2 kanal
328	Muhammad Ali	0345-7547155	1 kanal
329	Muhammad Azam	0341-6320360	3 kanal
330	Zulifqar Ali	0346-4103936	1 kanal
331	Ghulam Murataza	0346-7200727	2 kanal
332	Mazhar Iqbal	0345-2743065	2 kanal
333	Munir Ahmad	0345-4702202	1 kanal
334	Mirza Khan Bloch	0345-7528178	1 kanal
335	Muhammad Abbas	0345-7505199	1 kanal
336	Muhammad Akram	0343-6813233	1 kanal
337	Ghulam Shabeer	0334-4287224	2Acre
338	Sajjad Hussain	0300-4307586	1Acre
339	Ghulam Mustafa	03336430382	1 kanal
340	Haroon Abdul Rehman	03333399545	1 kanal
341	Muhammad Tanveer	03317305454	2 kanal
342	Saqib Ali	0333-4544657	1 kanal
343	Muhammad Ashfaq	0342-4138936	1 kanal
344	Azam Jutt	0303-4132176	4 Kanal
345	Allah Rakha	0306-9123493	1 kanal

Annexure 2

List of Importers of garlic and their contact numbers:

S.No.	NAME OF IMPORTER	Mobile number
1	ABDULLAH JAN & SONS.	0321-2115892
2	ANGEL ENTERPRISE.	0300-2385864
3	AL SAEED ENTERPRISE	0300-3853109
4	LEFRES.	0334-3028028
5	INAYAT ENTERPRISES.	0345-8531874
6	AMIN IMPEX	0300-9213504
7	SHEIKH IMPEX	0300-9564571
8	SUPER FRESH PRODUCE CO	0300-8240540
9	AL FAZAL INTERNATIONAL	0308-6784400
10	UBAIDA & BROTHERS	0300-8236337
11	WALI AND CO	0300-3853109
12	4 STAR IMPEX	0300-4751027
13	CROWN INTERNATIONAL	0347-2265887
14	M. SADIQ AND CO	0300-2235899
15	SAJID & YOUSAF IMPEX	0335-5209746
16	AHMED ENTERPRISES	0300-6621867
17	SOUVENIR TRADING CO	
18	AL MEHMAND ENTERPRISES	
19	GRAND ASIA TRADING CO	0316-6030629
20	FAISAL AND COMPANY	0321-9232896
21	DEWAN MUSHTAQ TRADE LTD	0301-8211396
22	NEMRA & NEDA ENTERPRISES	
23	PRIME IMPEX	0302-6141770
24	BASHIR SHABBIR & CO	0300-5383694
25	SADIQ & SONS	0300-3873126
26	A.K & SONS	
27	BASHIR TRADER	
28	TAMOUR ISHRAQ & CO	0300-6409229
29	GLOBAL FRUITS & VEGETABLE	
30	S.M TRADERS.	0333-3287590
31	CHAIRMAN & SONS	0300-4455489
32	USMAN ENTERPRISE	0313-2653874
33	BAWA HOUSE	

34	FIVE STAR INDUSTRIES	
35	M.M TRADERS	
36	JUMERAH ENTERPRISES	
37	ORIENTAL AGRO CHEMICALS	
38	ALKOZAIE BROTHERS	
39	KASIM SONS	
40	ANEEL & BROTHERS	0300-8557307
41	M.A SONS	0321-8453969
42	HAMID & SONS	0300-2563590
43	H.A SONS	0321-8473410
44	AAZ ENTERPRISE	0300-8263899
45	CHOUDHARY TRADING	0333-2247636
46	ADNAN ENTERPRISE	0300-2929878
47	AFZAL INTERNATIONAL	0321-8453696
48	AZMAT TAREEN & CO	0300-8263899
49	PAK VEGE FRUIT	0300-3661848
50	CHAND & CO	0300-7305605
51	S.S & SONS	0321-8210718
52	HAMZA BROTHERS IMPEX	
53	TWO STAR INTERNATIONAL	0300-4751027
54	MILLAT CORPORATION	
55	SHEIKH MOHAMMAD AFZAL	0300-2030611
56	VINCA BIOFOODS PVT LTD	
57	SALEEM JAN & SONS	0300-9270515
58	AFZAL SONS	
59	SHAHMIR IMPEX	0300-6621867
60	FAIR BRIGHT COMPANY	
61	PATWARI COMMISSION	
62	MEHR TRADING COMPANY	0333-2247636
63	GREEN LINK CORPORATION	
64	TRADESOL INTERNATIONAL	
65	SHEHROZ & IMRAN SONS	
66	KHAN BROTHERS	0300-3904516
67	SHAH MUSAFAR IMPORT	
68	BUSHRA IMPEX	0322-8221931
69	ASY INTERNATIONAL	