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SIGNIFICANCE, USE AND PRODUCTION OF POTATOES

Boltaev Murodbek Allayorovich
Doctor of Philosophy in Agricultural Sciences, Acting Associate Professor of
Tashkent State Agrarian University Tashkent Republic of Uzbekistan
murodbek boltaev.78@mail.ru

ANNOTATION

The article provides brief information about the meaning, use and production of potatoes, the technology of mechanized harvesting and post-harvest processing of tubers, outlines the theoretical foundations and storage technology, highlights the technology of pre-sale commodity processing, briefly describes the methods of processing potatoes for potato products and for technical purposes.

INTRODUCTION

Potato is currently in Uzbekistan, as in many other countries, is a favorite food product. People call it "the second bread".

Before Uzbekistan gained independence, the population's need for potatoes was met by imports from the Russian Federation and Belarus. Domestic potato production in our country was only about 350 thousand tons.

After gaining independence, potato production in our country began to grow due to the expansion of sown areas under this crop. In the first five years after independence, potato production per capita increased from 16 to 23 kg.

A powerful impetus for the development of potato growing and an increase in potato production was the resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated August 30, 1996 No. 301 “On measures to deepen market relations in potato growing and increase potato production in the republic”. Already in 1997, potato production in our country reached 692,000 tons. It was 30 kg per capita. The importation of ware potatoes from other countries was stopped.

In the republic, a course was taken to import the elite recovered from viruses and diseases, growing the first reproduction in seed farms, and the second reproduction in the seed-growing areas of commercial farms. The provision of high quality seeds has played an important role in increasing potato yields.

Potatoes began to be widely cultivated in dekhkan and farm enterprises, in household plots of the population. In 2000, the area under potato crops exceeded 50 thousand hectares. gross collection - 730 thousand tons. In subsequent years, potato yields and gross potato yields gradually increased.

Chemical composition and nutritional value. The potato, as a source of energy, ranks fifth in human nutrition after wheat, corn, rice and barley. It is one of the most important food for humans and animal nutrition. In addition, it is the most important raw material for a number of processing industries.

In the people, potatoes are aptly called "the second bread", "the priceless gift of the earth." 100 g of potato tubers are an energy source of 301.5 kJ or 78 kcal.

In terms of protein output per unit area, potatoes are second only to legumes. With a yield of 13.6 t/ha, the protein yield is 273 kg/ha. An increase in potato production can make a significant contribution to providing the population with food and, in particular, protein.

In a number of countries, potato is the crop that provides the highest yield of dry matter, energy and protein per unit area. So in the Netherlands, the highest production of units of energy per hectare is given by sugar beets and somewhat lower by potatoes, and much cheaper than wheat.

Different countries recommend different consumption rates for potatoes. In the northern temperate countries, where potatoes are well harvested and heat-loving fruits and vegetables are grown little, the recommended annual consumption of potatoes per capita is 120-150 kg. In the southern regions, where a wide range of fruits and vegetables is cultivated, the rate of potato consumption is recommended to be much lower. In Uzbekistan, the recommended annual consumption of potatoes is 54.6 kg per capita.

Depending on the variety, degree of maturity, soil and climatic conditions, the amount and composition of fertilizers applied, soil moisture and many other factors, the chemical composition of tubers varies widely. So the water content in tubers ranges from 63 to 87%, and dry matter from 13 to 37% (Fig. 1.1)

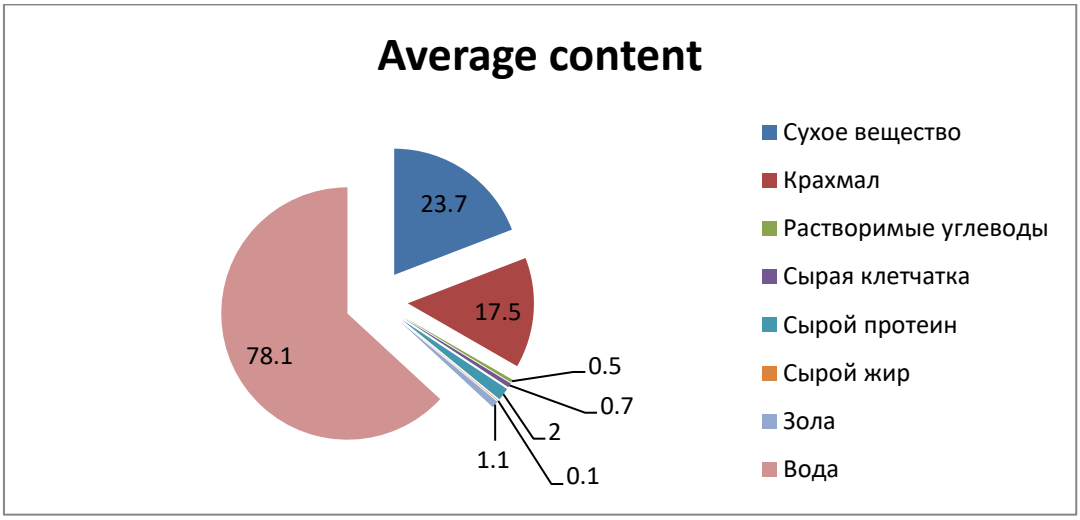


Fig.1.1 Chemical composition of tubers.

Use as a raw material for processing. Since the 90s of the last century, there has been a tendency to increase the production and consumption of potatoes. One of the reasons for this is the organization in many countries of the potato processing industry. Potatoes are presented to the consumer in more attractive forms: in the form of various prepared products or semi-finished products that have an appetizing appearance and require less cooking time than raw potato dishes.

In the US, up to 70% of the total potato is processed, only about 30% is consumed directly fresh. Potato processing is widely developed in many European countries. In Germany, about 60% of fresh table potatoes are processed for food. Almost half of it goes to the production of dried and more than a quarter of frozen products. More than 800 thousand tons of potato products are produced in the Netherlands. Potato processing is widely developed in France, Italy, Spain, Scandinavian countries.

In the Russian Federation, the processing of potatoes for potato products began to develop only after the collapse of the Soviet Union, and now about 20% is processed. The production of starch and alcohol in this country has been carried out since ancient times.

In Uzbekistan, potato processing is carried out only by a few small private enterprises, and the volume of processing is insignificant. In recent years, a potato processing plant has been built in Tashkent.

During processing for food products, potatoes are dried, frozen, fried in vegetable oil or animal fat, sterilized, and various semi-finished products are prepared. The use of potatoes for processing for technical purposes is important. It produces starch and alcohol. From 1 ton of potatoes, you can get 170 kg of starch or 80 kg of glucose. When processed for starch, 1 ton of potatoes gives another 0.7 tons of pulp used for livestock feed. From 1 ton of potatoes, 112 liters can be produced. ethyl alcohol, 55 kg of liquid carbon dioxide and, as a waste, obtain 1500 kg of stillage, also used for feed.

The production of starch from potatoes has long been established in many European countries and is carried out in large volumes. For example, in Germany, about 20% of the potato area is allocated to varieties with a high starch content in tubers. Here, the production of potato starch exceeds 460 thousand tons.

Potato starch consists of two fractions: amylopectin (75-80%) and amylose (20-25%). Amylopectin is insoluble in water and forms a suspension or jelly. Amylose is soluble in water and completely decomposes when heated with alkali, due to which potato starch is used in the chemical industry.

Potato starch is widely used in the food industry and cooking. It is used in sausage production, in the preparation of kissels and many dishes. It produces molasses and glucose.

Potato starch is widely used in various industries. It is used to prepare more than 500 types of products for the paper, textile, woodworking, construction, ceramics, and chemical industries.

The production of alcohol from potatoes has changed very little in recent years. Alcohol derived from potatoes is widely used to make vodka and other alcoholic beverages. It is indispensable in the pharmacological, perfumery, alcoholic beverage industries. It is used to make medicines, artificial rubber, which is used in many household products, and hundreds of other valuable rubber products.

Along with a wide use in cooking, for pet and poultry feed, processing, potatoes also have important agronomic importance. First of all, potatoes are an excellent predecessor for many crops, because of all tilled crops, it cleans the fields from weeds most completely. This is due not only to the ability to fight them during pre-planting and inter-row tillage, but also due to the fact that at normal planting density, potatoes close the aisles in a short time (after 7-10 days) after the last cultivation, inhibiting weeds. In addition, when harvesting potatoes, the remaining weeds are destroyed.

The potato is of great importance as an insurance crop in case of crop failure. Relative resistance to drought, wide plasticity, a large set of varieties, thanks to which it is able to adapt to various growing conditions, ensure higher yields than other crops in dry years and on poor soils.

Distribution of potatoes. The homeland of the potato is Central and South America, where its wild and primitive species still grow today. In the Andes of South America, Indian tribes grew potatoes more than 8,000 years ago. At the discovery of America, potatoes were not known in the central and southern parts of the contingent. Potatoes were first discovered by Spanish sailors in 1536-1537 in Peru, and in 1538 in Ecuador.

Potatoes were first brought directly from South America in 1562 to Spain and Italy, and in 1589 to England. In 1580 potatoes were brought from Italy to Belgium, from there in 1588 to Austria and Germany. At the end of the 16th and during the 17th century, it spread throughout Europe.

Potato first came to Russia 100 years after it entered Europe. The main importation falls on the middle of the 18th century.

In Europe, the potato was first cultivated as a medicinal plant in the gardens of pharmacists and in botanical gardens. The path of potatoes from the pharmacy garden to the peasant field took about a century and a half.

Potatoes came to Central Asia from Siberia in the 1950s. Much later, it penetrated most of the countries of Asia and Africa. In some countries, it was not known even at the beginning of the 20th century. At present, it has become an important food product in all countries of the world.

Potato first appeared in Uzbekistan in 1855-1856. near Tashkent, where it was brought from Siberia by fugitive Tatars. With the arrival of the Russians in Central Asia, part of the Tatars moved to Samarkand, and in the 70s of the 19th century they brought potatoes there.

The third center of potato distribution in Uzbekistan was the Fergana Valley, where potatoes began to be cultivated in the late 70s - early 80s of the 19th century after the arrival of the Russians. In Bukhara and Khorezm, potatoes began to be cultivated in 1892-1894.

The impetus for the development of potato growing in Uzbekistan was the emergence in the late 19th and early 20th centuries of railway stations, industrial and administrative centers with a Russian population, which demanded potatoes. Potato planting areas are expanding. For the first time, potatoes were cultivated only by Russian and Bulgarian gardeners, and then by local farmers.

World potato production. Potato is a valuable food, fodder and industrial crop. It is grown in almost every country in the world. In many of them, the potato is the main food crop. Potato production in the world is constantly growing. If in 1991 it was 268, in 1995 - 286, in 2001 -312, in 2007 -325 million tons, then in recent years 371-390 million tons.

The countries with the highest potato production in 2018-2019 were China (93-96 Mt), India (46-51 Mt) and Russia (33-34 Mt), which together accounted for 45% of world production . These countries are followed by Ukraine, USA, Bangladesh, Germany, France, Poland, the Netherlands, Canada and Belarus, which together account for another 25%.

The countries with the highest per capita potato production in 2019 were Belarus (591 kg per person), Ukraine (521 kg per person) and the Netherlands (350 kg per person).

In the world, there is a tendency to some expansion of sown areas and a very slow increase in yields. If in 1990-1991 the sown area was 17.7 million hectares, then in 2000 it was 18.8 million hectares, and in recent years it has stabilized at the level of 19-20 million hectares. Potato yield

in 1991 was 15.0 t/ha, in 2000 - 16.1 t/ha and in recent years has stabilized at 16.5-17 t/ha. These trends in the development of potato growing are typical for all continents.

The leading continents for potato production are Asia and Europe, where more than 80% of the world production of this crop is grown. About 8-9% of potatoes are produced in Africa, 5-6% in Latin America and 3-4% in North America.

The average potato yield in the world in 2019 was -21 t/ha. The highest yields were achieved in the following countries: Kuwait, the Netherlands, Belgium, New Zealand, UK, Denmark, USA, Germany, France, Ireland and Switzerland. The lowest yield of 4.0-5.5 t / ha of potatoes in the countries - Cameroon, Nigeria, Congo and Bolivia.

Potato production per capita per year in the world is 34.2 kg, in Belarus, Ukraine, Latvia, Russia, Kazakhstan, Poland, Great Britain, Kyrgyzstan within 100-590 kg.

Higher yields of potatoes are usually obtained in countries with more favorable climatic and soil conditions for this crop: North and Central America, Western Europe. In Europe, the best conditions for growing potatoes are in the strip located between 50 and 530 N: Northern France, Austria, Belgium, Germany, the Netherlands, Southern England and Ireland. Outside this region, favorable conditions for potatoes exist only in certain areas, for example, in Norway, where the influence of the warm Gulf Stream affects, as well as in the mountainous and mid-mountain conditions of Italy, Spain, Portugal, and Greece.

In Southern Europe, most parts of Asia and Africa, potatoes suffer from high summer temperatures. The low yield of potatoes in these regions is largely due to the fact that cultivars are poorly adapted to growing in tropical and subtropical climate zones.

Differences in potato yields across countries are largely due to the level of intensification of cultivation. In many countries with high yields, seed production is clearly established, based on the improvement of potatoes by the meristem method, they use high-quality virus-free seed material, apply advanced technologies for growing and harvesting potatoes using balanced mineral nutrition and effective plant protection products from pests and diseases.

The global potato market is growing year by year. In 2019, compared to 2015, it grew by 6% and reached a record level - up to 140.5 billion US dollars, increased for the third year after a two-year decline. Since 2007, the market value of potatoes has been growing by an average of 3%.

In 2019, shipments of potatoes abroad increased by 4.9% to 15 million tons, increasing for the fourth consecutive year after a two-year decline. Total exports increased by an average of 3.2% per year from 2007 to 2019. However, the nature of the trend indicates some notable fluctuations recorded in certain years.

In value terms, potato exports rose rapidly to $4.8 billion (IndexBox estimates) in 2019. The total value of exports increased by an average of 2.8% per year from 2007 to 2019; however, the nature of the trend indicates some notable fluctuations recorded throughout the analyzed period.

In 2019, the largest exporters of potatoes were: France (3.5 million tons), Germany (1.9 million tons), the Netherlands (1.8 million tons), Belgium (1 million tons) and Egypt (0. 7 million tons) The combined share of these 5 countries reached 60% of total exports. Pakistan (625 thousand tons), USA (550 thousand tons), Canada (504 thousand tons), China (471 thousand tons), India (417 thousand tons), Spain (303 thousand tons) and Saudi Arabia (294 thousand tons).

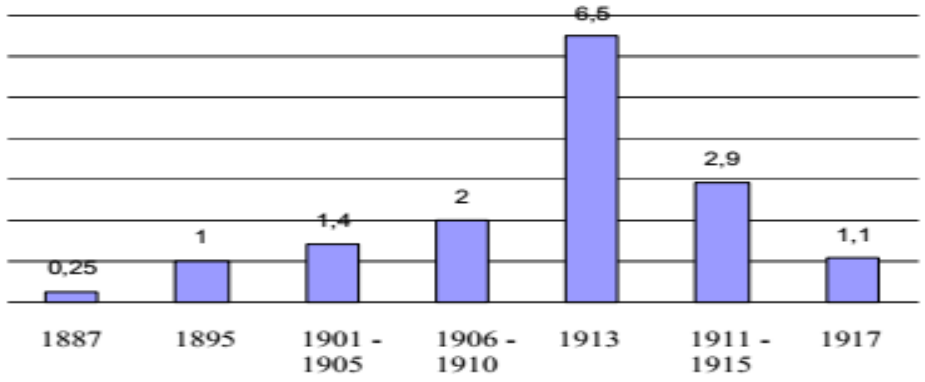
In value terms, France ($812 million), the Netherlands ($800 million) and Germany ($440 million) became the world's largest potato supplier countries, with a combined share of 43% of the world expert. These countries were followed by China, Egypt, USA, Belgium, Canada, Spain, Pakistan, India and Saudi Arabia - 35% of world exports.

In 2019, the average export price for potatoes was $323 per ton, up 4.1% compared to 2018. The most notable growth was recorded in 2011, when the export price increased by 18% year on year and peaked at $375 per tonne. In 2019, China had the highest export prices ($613 per ton) and Saudi Arabia the lowest ($170 per ton).

Potato production in Uzbekistan. Potatoes have been grown in Uzbekistan since the 1950s. Its distribution was slow and by the end of the 80s of this century, the potato sowing area did not exceed 250 hectares, and the yield was 5-6 t/ha.

At the end of the 19th century, the sown area under potatoes began to grow and their growth continued until the outbreak of the First World War. In 1913, the area under potato crops reached 8.5 thousand/ha. Potato yield during this period was 5-7 t/ha.

Since the beginning of the First World War, the area under potato crops began to decline sharply (Fig. 1.2)



Rice. 1.2. Dynamics of sowing potato areas in Uzbekistan in the late 19th - early 20th centuries, thousand ha.

Until the end of the 20s of the last century, potato growing in Uzbekistan developed slowly, then during the period of collectivization of agriculture, it began to develop rapidly. Before the Second World War (1940), potatoes in Uzbekistan already occupied 18.3 thousand hectares, and the gross harvest amounted to 113.3 thousand tons. against 6.5 thousand hectares and 46.2 thousand tons in 1913. During the Second World War, the area sown and gross yields of potatoes decreased again, and the pre-war level was reached only at the end of the 50s.

From the mid-1950s to the beginning of the 1980s, the sown area of potatoes changed little and amounted to 22-24 thousand hectares. However, during this period, the yield steadily increased (from 6.5 to 9.6 t/ha). Due to the increase in yield, the gross harvest of potatoes during this period increased from 159.1 to 216.3 thousand tons.

From the beginning of the 80s of the last century until the acquisition of independence by Uzbekistan, there was a significant expansion of the area sown with potatoes. In 1991, it

amounted to 40 thousand hectares. Despite the lack of yield growth, the gross potato harvest over the last twenty years of the last century increased from 216.3 thousand tons. up to 351.2 thousand tons (Table 1.2)

Table 1.2

The dynamics of the development of potato production before the acquisition Republic of Uzbekistan independence

Indicators	1940 y	1951-1955y	19591960y	1961-1965y	1966-1970y	1971-1975y	1976-1980y	1981-1985y	1986-1990y	1991y
Cultivated areas, thousand hectares	23,6	21,4	24,4	24,3	21,8	23,5	22,5	31,5	33,8	40,0
Productivity, t/ha	4,8	5,8	6,5	6,8	7,9	8,3	9,6	9,7	9,1	8,8
Gross collections, thousand tons	113,3	124,2	159,1	165,4	172,3	195,2	216,3	305,2	307,5	351,2

Before Uzbekistan gained independence, about half of the potato crop area was concentrated in the collective farm sector. The rest was located in state farms and household plots of the population. Potatoes were grown both in specialized farms, where the potato area was 200-300 hectares, and in non-specialized ones. Own production of potatoes per capita at that time in Uzbekistan was only 15-17 kg. and the need for this product was mainly satisfied by importing it from Russia, Belarus and the Baltic states. Every year, 300-350 thousand tons of food and 100-120 thousand tons of food were imported to Uzbekistan. seed potatoes.

Prior to independence, there was practically no elite and primary seed production in Uzbekistan. Potato cultivation was based on imported planting material.

After gaining independence in our country, the task was set to provide the population with potatoes mainly through their own production. This required a significant increase in production.

From the first years of independence, potato sown areas began to expand, its productivity and gross yields increased. Already in 1994, the area under potato crops reached 53.0 thousand hectares, and the gross production - 567 thousand tons. Subsequently, until 2007, with the exception of 1995 and 1996, when due to a lack of seed material, the sown area and gross yields of potatoes decreased, the area sown with potatoes amounted to 48.5 - 56.7 thousand hectares, the yield steadily increased, and the gross yields steadily increased. In 2001, the yield exceeded 20 t/ha, and the gross harvest - 1 million tons.

The implementation of the Decree No. 301 of August 30, 1996 “On measures to deepen market relations in potato growing and increase potato production in the republic” adopted by the Cabinet of Ministers of the Republic of Uzbekistan played a large role in this. By this decree, the Uzkartofel company was created, uniting 26 potato-growing farms. The firm was given the task of meeting the needs of the republic's farms in seed potatoes by creating their own seed-growing base and importing seed potatoes from outside the republic for variety renewal. The Decree provided for the annual importation of seed stock for variety renewal in the amount of

25 thousand tons, the annual cultivation of seed potatoes on an area of 7 thousand hectares and the production of 126 thousand tons from this area. including seed material 84 thousand tons. By 2005, the creation of our own seed-growing base made it possible to raise the yield from 11.7 t/ha to 18.6 t/ha by 2005 compared to 1996, and to increase the gross harvest to 924 thousand tons. More than 30 kg were produced per capita. This made it possible at the end of the 20th century to completely abandon the import of food potatoes and reduce the import of seed potatoes, limiting it only to the import of elite and class A.

In recent years, a steady expansion of potato sown areas has continued in Uzbekistan. In 2010, the area sown with this crop is expanding to 87 thousand hectares, in 2019 to 121 thousand hectares and in 2020 to 139 thousand hectares. Gross yields of potatoes are also growing. In 2010 they reached 1 million 694 thousand tons, in 2016 they exceeded 2.0 million tons. and in 2019 - 3 million tons. The yield of potatoes in recent years has fluctuated between 20-24 t/ha (Table 1.3)

Table 1.3

Dynamics of sown areas, yields and gross yields of potatoes in Uzbekistan during the years of independence

years	Sown area, thousand hectares	Yield, thousand tons	Gross harvest, thousand tons	Years	sowing area, thousand ha	Yield, thousand tons	Gross harvest, thousand tons
1991	40,0	8,8	351,2	2006	52,6	19,4	1021,0
1992	42,9	8,5	365,3	2007	55,6	21,4	1188,1
1993	44,5	10,6	472,4	2008	59,7	23,4	1398,7
1994	53,0	10,7	567,1	2009	62,9	24,3	1530,9
1995	45,9	10,0	459,0	2010	87,0	19,5	1694,2
1996	44,0	11,7	513,6	2011	95,2	19,6	1862,6
1997	56,7	12,2	691,9	2012	101,0	20,4	2057,1
1998	54,2	12,8	691,4	2013	106,8	21,1	2250,4
1999	48,5	13,4	657,8	2014	114,8	21,4	2452,4
2000	52,2	14,0	731,1	2015	123,1	21,9	2696,9
2001	50,3	14,8	744,4	2016	131,5	22,5	2958,4
2002	48,8	15,9	777,2	2017	24,2	21,8	2793,7
2003	49,2	17,0	834,4	2018	129,5	22,5	2911,8
2004	52,1	17,1	895,7	2019	135,8	22,1	3088,8
2005	49,8	18,6	924,2	2020	139,0	21,2	2967,0

Potato production per capita reached 86 kg. Opportunities arose for the export of potatoes to other countries.

The increase in gross yields of potatoes occurs not only due to the expansion of sown areas, but also due to an increase in productivity. So if in 2005 it was 18.6 t/ha, then in 2010 it was 19.5 t/ha, and in recent years it has reached 21-24 t/ha.

In Uzbekistan, great attention is paid to the development of potato growing by the leadership of the republic. On February 23, 2018, a resolution of the President of the Republic of Uzbekistan "On measures to further develop the cultivation of seed potatoes in the republic" was adopted. This resolution established the Association of Potato Producers, which united Agrover LLC, Simliklar Tekhnologiyasi, territorial potato growing centers, as well as farms producing seed potatoes. In addition, based on the soil and climatic characteristics, 8 regions

of the republic are specialized in growing seed potatoes. Seed potatoes are grown by farms that are members of the Association.

Further directions for the development of potato growing in Uzbekistan are determined by the Decree of the President dated May 6, 2020 No. PP-4704 "On measures to expand. Potato production and further development of potato seed production in the republic. In accordance with this resolution, the country must fully provide itself with potatoes of its own production. For this, potato-growing clusters and cooperations have been created, the main activities of which are: meeting the demand for food and seed potatoes in the domestic market, expanding its exports; organization of seed potato production; organization of storage, selection, delivery and processing of seed potatoes; introduction of advanced technologies, innovative solutions (noy-xay) and scientific achievements in the field of potato growing.

Growing potatoes in the regions of Uzbekistan is distributed unevenly. It is mainly concentrated in suburban and foothill areas. On average for 2017-2019, with an average annual production of 2930 thousand tons. the main producer is the Samarkand region, which produced 591 thousand tons or 20.7% or one fifth of the total gross harvest in the republic over an average of three years. The second place in the production of potatoes in the republic is occupied by the Tashkent region, which produces 12.3% or one eighth of the country.

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