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New Plants With Commercial Potent

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Abstract

It is expected that the worsening of global warming and climate change will increase the frequency of droughts across many regions of the globe, possibly causing arid/drought conditions to become permanent. For this reason, many scientists are preparing for future scenarios that might require changes in the pattern of crops and plants being cultivated in different regions. Both the possibility of the depletion of fuel sources in the near future and the increased occurrence of droughts have compelled many people to use new plants as food and energy sources, and/or to use previously known plants in novel and different ways. To satisfy the demand for food and raw materials of the increasing population and to ensure food security, the use of new plants in agriculture is being increasingly considered. Agricultural production not only satisfies a population's demand for food, but also constitutes a large portion of the income of certain developing countries. In such countries, agriculture also provides employment for a sizeable portion of the population. In this context, it is important to investigate the potential uses of plants from the Mediterranean region of Turkey such as Quinoa, Amaranth, Crambe, Lesquerella and Echinacea in various areas such as energy, food, cosmetics, plastics and medicine. It is thus necessary to determine methods for ensuring effective agricultural production and yield with these plants, to effectively implement such methods, to perform the necessary economic analyses relating to these plants, to expand the food production potential of countries, and to also create sources of additional revenue by utilizing these new plants.

Keywords: Alternative plants, new plants, climate change

Ticari Potansiyeli Bulunan Yeni Bitkiler

Özet

Günümüzde İklim değişiklikleri sonucu kuraklıkların ortaya çıkması ve artan küresel ısınma ile birlikte bu durumun geniş bölgeleri kapsaması ve kalıcı olduğunun öngörülmesi bir çok bilim adamını gelecekte bazı bölgelerdeki ürün deseninin değişeceği senaryolarına karşı hazırlıklı olmaya mecbur kılmıştır. Gerek petrol kaynaklarının çok yakın bir gelecekte tükeniyor olması gerekse artan kuraklık hem gıda hem de enerji açısından insanları yeni bitkilere ya da bilinen bitkilerin yeni kullanımlarına yönlendirmiştir. Artan nüfusun gıda ve hammadde ihtiyacını karşılamak için yeni bitkilerin tarımsal üretimde gıda güvenliğini sağlamada gündeme getirmiştir. Tarımsal üretim sadece nüfusun gıda ihtiyacı değil, aynı zamanda gelişmekte olan ülkelerde gelirin büyük payını oluşturmakta ve önemli oranda iş gücü istihdamı da yaratmaktadır. Enerji, gıda, kozmetik, plastik ve tıpta farklı kullanımlarıyla ülkemiz Akdeniz bölgesinde Quinoa, Amaranth, Crambe, Lesquerella, Ekinezya gibi yeni bitkilerin tarımsal üretiminin verimlilik yöntemlerinin belirlenmesi, uygulamaya aktarılması, ekonomik analizlerinin yapılması, ülkelerdeki gıda üretim potansiyelinin genişletilmesi ve ek gelir sağlamak için önem arz etmektedir.

Anahtar Kelimeler: Alternatif bitki, yeni bitkiler, iklim değişikliği

Introduction

Excessive natural resource utilization together with industrial revolution, resultant environmental pollution and current climate change and global warming trend exert ever-increasing pressure especially on agriculture. Such heavy pressures have brought future agricultural production scenarios into agendas of the countries.

Among the natural resources, renewability of soil and water resources are continuously decreasing. Beside their socio-economic values, these two resources are vital resources for humanity (Kadıoğlu, 2007). Soil and water use are the most significant issues of both agricultural and industry. Recent drought-induced salinity and heavy pressures exerted over these resources have brought together the concept of efficient soil and water resource-use to provide sustainability of both these resources and agriculture. In the future, around 2080s, a 0-0.5% decrease is estimated to be observed in agricultural production of Turkey. Negative impacts of global warming on agriculture are usually observed as yield loss in dry regions. Global warming-induced droughts result in temperature stress over the plants in irrigated farming regions and yield losses are evident even with sufficient irrigations. Excessive temperatures increase the number of irrigations in irrigated farming. Such a case then result in excessive surface and groundwater uses to meet the water requirements of the plants (Türkeş, 2008). Today, worldwide sustainable agriculture, efficient soil and water use to meet the ever-increasing food demands of people, sustainability of traditional agricultural systems, introduction and widespread culture of new plants such as quinoa, amaranth, crambe, Lesquerella, Echinacea to provide an extra income and employment to farmers, readiness to possible changes in cropping patterns because of climate change scenarios and to make yield researches for such plants, presenting locally available opportunities, implementation and practices by taking country.

New plants

Quinoa (Chenopodium quinoa Wild)

The year 2013 was declared by the United Nations as the quinoa year. Quinoa is an annual plant of Chenopodiaceae family and there have been several researches carried out on quinoa (Miranda et al., 2012). Production, possible uses and benefits of quinoa have recently been placed in scientific researches and showed up in press releases. Motherland of the plant is South America and it has been cultivated as the main food source throughout the Andes Region of South America in Bolivia and Peru for more than 7000 years. Although it has been widely consumed and researched in the USA, it is a relatively new and recently-heard plant in Turkey. It has a broad food-use potential and commonly cultivated worldwide in regions covering Bolivia, Peru, Ecuador, Colombia, Argentina and North of Chile (Schulte auf'm Erley et al., 2005).

It is an annual, broad-leaf and drought-resistant plant with tap roots. Plant height is between 40-150 cm (Bhargava et al., 2007). The plant is cultivated even over marginal soils of South America and can survive under extremely cold conditions (Anonymous, 2014a). The plant has an extraordinary salt-tolerance and several species can be grown at high salt concentrations (40 dS/m) close to sea water (Garcia, 2003).

Some experts indicated quinoa as the plant to overcome the hunger problem of the world. Seeds are used as human food source like cereals and legumes and trade of the plant has been increasingly widespread throughout the world. It has been used in human nutrition in American continent for centuries and it has been pointed out as the food source and forage plant of the future in Europe (Jacobsen et al., 1993; Sigsgaard et al., 2008; Bertero et al., 2010). Although protein ratios significantly vary from species to species, the seeds have significantly higher protein ratios (20%) than wheat, rye, oat, maize and rice (Bhargava et al., 2007; Repo Carrasco Valencia et al., 2011).

Quinoa seeds are highly nutritious human nutrient. The seed contain protein, mineral and all vitamins and are rich source of vitamins. Quinoa seeds do not contain cholesterol. Oil ratios of the plant are lower than the other oil crops but higher than cereal crops (Miranda et al., 2012). Seeds contain all of the 8 essential amino acids required for muscle development in humans. Therefore, quinoa is accepted as a wonderful protein source (Repo Carrasco Valencia et al, 2011).

Since quinoa does not contain gluten protein, it is also used to meet the protein and carbohydrate needs of coeliac patients and vegetarians sensitive to gluten (Reichert et al., 1986). With such a nutritive characteristic, it is also suitable for nutrition of children and people on a diet (diets without gluten). Despite high nutritive value of the seeds, seeds are coated with thin bitter saponin scab based on plant species. Thus, saponin should be removed from the seed before to use either mechanically or by immersing into water (Ward, 2000). Quinoa is primary used in production of bread, macaroni, biscuits-like baked products, in gluten-free diets, in cosmetic industry, shampoos and various skin care products, in rice and meals similar to paddy as a kernel, in production of alcoholic beverages and leaves are used in salads and cold dishes. Quinoa plants are also used in feed industry as green herbage or silage (Sezen et al., 2013)

Quinoa with its nutritive values is an available plant for both arid and semi-arid climates. Decreasing rice productions and increasing costs due to global climate change and droughts have increased the tendency toward the alternative products like quinoa. Quinoa, characterized with a rich inter-special diversity, can be cultivated under different climate conditions, can be grown in arid and semi-arid regions at altitudes up to 4000 m like Andes and can be incorporated into crop rotation plans of lower altitudes with wheat, maize, potato and barley (Christiansen et al., 2010; Aguilar at al., 2003). Researches should be carried out in Turkey about basic issues in quinoa culture to introduce this plant to Turkish farmers and to provide an alternative source of income to them.

Amaranth (Amaranthus spp.)

Amaranth is a member of Amaranthaceae family. It is originated from Central and South America and around Andes and has a great genetic diversity cultured throughout the world (Sun et al., 1999). Because of nutritive value of the seeds, Amaranth was called as "golden cereal of the God" by Aztecs (Becerra, 2000). The plant, cultivated 8000 years ago by Aztecs, is used as local cereal crop in Peru (Anonymous, 2014b). It has been widely cultivated in several parts of the world and the USA, China, Poland and Austria produce it as commercial food stuff (Berghöfer et al., 2002).

It is estimated that amaranth has 87 species (Mujica et al., 2003). Plant height varies between 91-274 cm and it has a yield level of between 720-1320 kg/da (Aufhammer et al., 1995, Spehar et al., 1998). Couple species of the plant were taken under culture and the rest is grown as weed in nature of trophic and sub-trophic regions.

Amaranth is able to be grown under severe environmental conditions (Berghöfer et al., 2002). Water requirement of amaranth is about 42-47% of water requirement of wheat, 51-62% of maize and 79% of cotton (Kauffman et al., 1990). Because of C4-type photosynthetic characteristics, amaranth is highly resistant and adaptive to droughts and can easily be grown for grains in semi-arid regions as the cereal crop of the future (Hauptli, 1977; Putnam, 1990).

Different from maize, wheat and rice-like culture crops, amaranth leaves can be consumed as fresh vegetable besides being used as kernel. Amaranth is also defined as natural cereal free of gluten and has higher protein and amino acid contents (12-18%) than the other cereals. Thus, the plant has been the research focus of several researchers (Bjarklev, 2007; Ahamed et al., 1998). With about 77% saturated acid content, amaranth has three times higher saturated acid content than maize. The plant is used in nutrition and diet programs. It is also primarily used in bread, cakes, cookies and other popped food stuff. Some amaranth species are also used in livestock industry to meet the forage demands of animals (Stallknecht et al., 1993). It is sometimes used in paint and cosmetics industries. Just because of high fiber content, balanced saturated fatty acid content, protein and amino acid composition complying with the standards of FAO, amaranth is used to produce healthy food stuff for human nutrition in various parts of the world (Thanapornpoonpong, 2004).

Crambe (Crambe spp.)

Crambe is a member of brassicaceae family and it is an annual or perennial oil crop. There are about 30 species of the plant throughout the world. The origin of crambe is Iran-Turan sites of South-East Asia and Mediterranean Region (Knights, 2002). Crambe species can grow under extreme conditions (-20°C), can be grown either in winter or spring. It has a high adaptation capacity, low plant nutrient requirement and is highly tolerant to drought. Therefore, it is seen over large areas extending from Asia to Western Europe. Crambe is considered as a potential promising crop with its high adaptation capacity (Glaser, 1996; Grombacher et al., 1993). In Turkey, C. tataria, C. Orientalis and C. maritima species of Crambe L. cultivar are naturally widespread in central western and Black Sea regions (Tansı et al.,2003; Davis, 1965; Kürşat, 1999).

Oil characteristics of Crambe seeds have been investigated in various researches. Seed oil is highly rich in erucic acid with high boiling and evaporation points (299°C). The seed oil is able to resist against significantly high temperatures and able to stay as liquid at low temperatures (Grombacher et al., 1993). Beside these characteristics, Crambe oil has biological decomposition ability. Such ability is highly significant with regard to environment. The oils, rich in erucic acid, are used in various areas of the industry such as anti-blocking agent in polyethylene films, adhesive in printing houses, as anticorrosive material, in steel sheet metal industry, textile industry, detergent, perfume and various other industries (Tansı et al., 2003; Erickson et al., 1990). Experimental researches on cultural practices revealed that Crambe seeds have an oil content of 46% and protein content of 27% (Gastaldi et al., 1998). The pulp after the oil extraction is also highly rich in protein and amino acids and used in feed industry. With all these characteristics, crambe is a promising "new" crop. Thus, researches should focus on culture and chemical characteristics of this crop (Çömlekçioğlu, 2005).

Limited agricultural land resources and unavailable climate conditions limit the diversification of agricultural products. Recently, renewable agricultural products have been started to be used in various industries as fuel, lubricant or bio-plastic in Europe and the USA. Crambe has also a great industrial potential. With regard to industrial potential, C. abyssinica species of crambe is highly rich in erucic acid. Turkey is significantly rich in biologic diversity and crambe is a significant industrial crop for the country to improve its potential through using own resources, to develop the economy, to preserve biodiversity and gen sources (Köybaşı, 2008).

Lesquerella fendleri (A.Gray) S.Wats.

Lesquerella fendleri is a member of Brassicaceae family. It is naturally grown as desert plant in the USA, southwestern Mexico and Arizona (Rollins, 1993). Lesquerella fendleri is an oil crop with plant heights between 25-40 cm, leaf widths between 1-4 cm and lengths between 1-6 cm. One thousand kernel weight of the seeds vary between 0.5-1.2.g. Average yield level is around 1800 kg/ha and such a level may be increased to 2500 – 3000 kg/ha with agronomic and breeding practices (Dierig, 2009). Seeds of lesquerella fendleri have a protein and amino acid contents of between 30-35%. Oil content of seeds is between 25-34% and lesquerolic acid constitutes about 74% of this oil content (Dierig et al., 2004).

Researches have been carried out about lesquerella species in the USA by the agricultural research centers of USDA since 1960 for the revival of the rural economy. Hydroxyl (OH) oil acids are good sources of substance for environment-friendly lubricants. Today, hydroxyl oil acids are commonly used in varnishes, plastic and biodiesel industries, used to prevent bubbles in automatic washing machine detergents and softeners, used as jet fuel, in cathartic production in medicine, lip stick production of cosmetics industry and as consistency agents in industry. Lesquerella fendleri, similar to castor oil, may be used as a new local oil crop alternative to castor oil (Puppala et al., 2005).

It was estimated that among the sectors influencing human life, agriculture will suffered the most from future climate change. Drought, salinity and high temperature-like stress factors will definitely negatively affect the plant production. As it was already practiced in some regions of the world, limitations will also be brought to water use in irrigations of Turkey. Within this perspective, lesquerella fendleri may create a common impact and value-added in plant production of the country and in water-saving since it can grow in desert flora.

Echinacea (_Echinacea spp.)_

Echinacea is a member of asteraceae family. It is a perennial herbaceous plant, widely known as purple cone flower. It is a natural medicinal and aromatic plant of northeastern America. In general, 3 types of Echinacea (E.purpurea, E.angustifolia, E.pallida) are commonly used for medicinal purposes and researches have widely been implemented over these 3 species. The plant has widespread from North America to world since 17th century. It strengthens defense system, thus it is mostly used for medicinal purposes. American Indians used this plant in treatment of various diseases (mumps, insect bites, stomach and head ache as pain reliever, cold, snake bites) and used as antidote in various poisoning cases (Muntean et al., 1998).

Increasing demands for medicinal plants speeded up the spread of Echinacea production throughout the world (Li,1998; Bruneton, 1999). Both above and below soil surface parts of echinecea plants are used for medicinal purposes. Just because of economic and medicinal significance of the plant, echinecea culture have been practiced especially in European countries, America, Africa, Middle-East and Asia (Letchamo et al., 2002). In the past, while echinecea-like medicinal and aromatic plants were used as incense in religious ceremonies and as drug to treat diseases, today the plant is used in various other industries such as aromatic energy drinks, in food industry, textile paints, cleaning products, landscaping and cosmetics (Craker, 2007).

Echinacea species generally have taproots and can grow stony soils poor in plant nutrients. The plant usually grows in cool climates, but highly resistant to droughts of hot climates. Therefore, it has a significant widespread throughout the world (Kindscher, 2006).

Recently, since the consumers have more knowledge about their heaths and mostly focused on better lives, they tended to use natural or organic foods or relaxing beverages and herbal treatments has then regained their popularity. Echinacea has a potential consumption in the future. In the year 2009, sales of energy-drinks decreased dramatically because of their caffeine and alcohol contents. Then, such drinks substituted with herbal drinks (Craker, 2007; Joy et al., 1998).

Researches should be carried out to determine the suitability of echinecea species for ecological conditions of Turkey since it is a significant medicinal plant with broad adaptation capacity and consumption potential in the future. It is not among the cultural crops of Turkey and potential culture of the plant will create new industries in regions where it is cultured and revive the rural economy and employment (Küçükali, 2012).

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