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IPGA

India Pulses and Grains Association

PULSE INDIA

Recipe of the Month

Guacamole Tarlets

In This Issue:

Trade and Research Journal on Pulses

INDIA PULSES AND GRAINS ASSOCIATION

presents

THE PULSES CONCLAVE 2018

THE LEELA AMBIENCE CONVENTION HOTEL
NEW DELHI

February 14 - 16 , 2018

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From the Chairman's Desk

Dear friends,

I am delighted to announce that India Pulses and Grains Association hosted its first ever National Pulses Seminar 2017 in Kolkata on 25th March this year and the Seminar was a huge success. IPGA witnessed participation of over 350 delegates from all across the country. One of the key presentations during the Seminar was regarding GAFTA Regulations which was delivered by Mr. Shailendra Bardia, GAFTA Arbitrator in India.

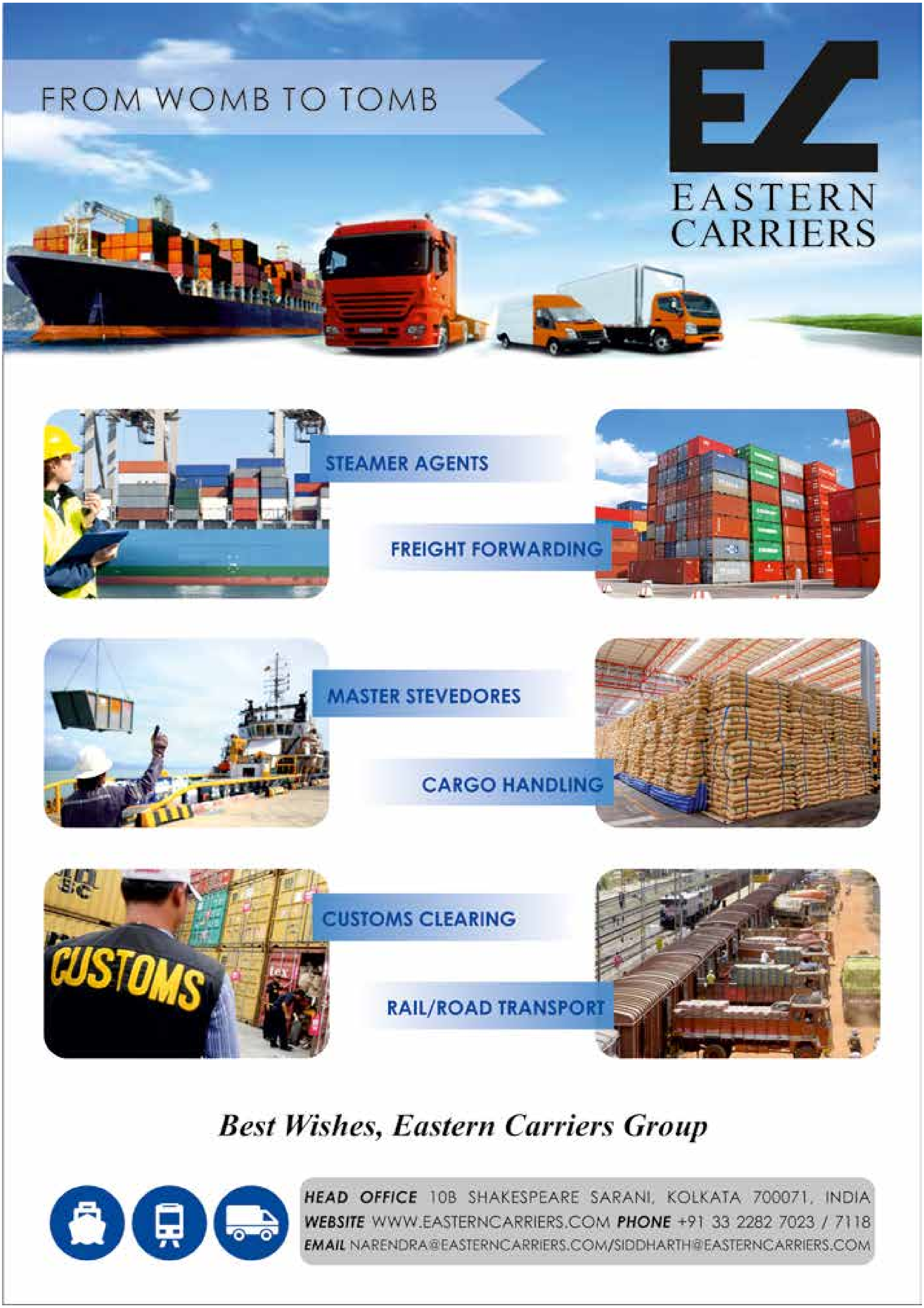
Friends, in our ongoing endeavor, to provide our members with seamless and well researched information, I am pleased to welcome Dr Yadnya Pitale, who has joined the IPGA team as Chief Operating Officer. Yadnya, among other qualifications holds a PhD in financial management and is an MBA in finance with nearly 2 decades of experience in the field of research and analysis.

A section dedicated to a particular pulse has been introduced from this issue of Pulse India so that the reader has access to the knowledge of the selected pulse in entirety. This section will include expert articles including Crop and Trade outlook, Research Advancements, International Recipes etc. connected to the selected pulse. This issue of Pulse India is carrying information on Chickpeas. The issue carries an article on current Chickpeas Trade and Price outlook by Mr. Rajat Sarda, Managing Director, Rajat Agro, valuable inputs on chickpeas nutrition & goodness by Mrs. Naaznin Husein, President, Indian Dietetic Association (IDA) Mumbai Chapter and some chickpeas based recipes. I hope you will find this new section as an interesting read.

On the invitation of the Argentinian Minister of Agriculture, delegation of IPGA members travelled to Argentina and had very fruitful meetings with various Ministries, Trade Associations, Producers and Processors from across the provinces of Buenos Aires, Cordoba and Salta. There was productive dialogue and we hope that this is the beginning of a long and mutually beneficial relationship with Argentina.

Our membership continues to increase by the day and we had several Associations enlisting as IPGA members, increasing the reach of the Association across India and covering the entire supply chain.
Last but not the least, I am delighted to announce that IPGA will be hosting the 4th edition of its biennial event, The Pulses Conclave from 14th to 16th February 2018 and we expect a record participation at this event from stake holders across the globe.
Warm regards,

Pravin Dongre
CHAIRMAN
India Pulses and Grains Association



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Kabuli Chick Peas: Price & Production Perspective

Rajat Sarda
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Kabuli Chick Peas, very well classified as the fairer member of the Chick Peas (Cicer Arietinum) family. Kabuli Chick Peas is truly a global pulse as it is probably the only member of pulses family to be consumed in most countries. With the increasing price and consumption it has attracted attention of farmers across the world. It is now being widely planted across the world in many countries and the production continues to increase since last one and a half decade.

Kabuli Chick Peas (KCP) are broadly classified into two main varieties (a) Blanca Sinaloa Type (b) Spaniola Type. Blanca Sinaloa type KCP originated in Mexico is big sized Chickpeas mostly 9 mm to 14 mm in size, has more whitish colour as compared to the Spaniola type. It is now successfully being planted in India, Mexico and Morocco.

Spaniola type KCP is small sized chickpeas mostly 6 mm – 10 mm, has an off-whitish to light brown colour. It is widely grown in Turkey, Iran, Argentina, Spain, Italy, USA and Canada.

Until 2002-03 India was majorly an importer of Kabuli Chick Peas importing from Mexico, USA, Canada, Turkey, Iran and Argentina. With the increase in consumption of Kabuli Chick Peas and the price premium compared to Desi's farmers in India, especially Madhya Pradesh, were motivated to try growing this variety. Prior to that India only had very small caliber Bitki (4-5-6 mm Kabuli Chick Peas) grown in India around Dabra/Gwalior, M.P. and in some areas near Akola, Maharashtra. From 2000 to 2005 most imported varieties from Mexico, USA, Turkey and Iran were tried by Indian Farmers, but the Mexican or Blanca Sinaloa type soon gathered popularity because of its bold size and huge export potential. Indian farmers called it "Dollar Chana" primarily because of its big size (10/14 mm) and secondly because it was being exported and fetched US Dollars into country. Post the 2006 ban on export of Pulses from India, KCP remain the only pulses, which is allowed for export. With the increase in demand in the domestic as well as international market the production of KCP in India has increased from mere 15000 MT in 2000 to 400,000 MT. And the export has gone up from 4000 MT in 2003 to around 200,000 MT. Indian KCP exports Industry is now worth over US $ 200 million and growing.

Production Paranoia

KCP production saw a consistent growth from 2009 till 2013 and thereafter the production remained stagnant at around 450,000 MT till 2015. At the beginning of 2016 crop, India had negligible carryover left from 2015. The sowing forecast was moderately low for 2016 but due to relatively warm winter the yields dropped in traditional sowing areas resulting in a steep decline in production by 50% to 225,000 MT. This drop of 50% in Indian production coupled with lowest Mexican production in last 4 years of around 85,000 MT, created an acute shortage of large caliber KCP in world market. The world market did not anticipate this production disaster and traders rushed to secure KCP from all corners of the world. Argentina, USA and Canada were fully booked within a few weeks. After a long time veteran KCP exporters Turkey and Iran came out of hibernation to export KCP but couldn't improve the supplies, to ease pressure on prices. Meanwhile inventories in India and Mexico were continuously getting consumed with availability becoming more and more difficult. During September festival demand from Iraq due to Muharram and thereafter the winter demand from Algeria and Europe. Once again the world market was looking at Argentina, USA and Canada for KCP, which were due to harvest from October. But the weather in Canada spoiled the KCP crop, severely affecting quality as well as quantity. On the other hand Argentina had yet another year when rains during harvest spoiled the quality of sizeable crop. Despite these events most of the KCP from these origins was contracted or shipped before Indian 2017 KCP crop went into harvest. At the same time Mexicans forecasted their 2017 crop to be around 125,000 MT. And trying to take the first mover advantage over Indians they sold some 6000 MT of KCP into Turkey at unbelievably low price of USD 1400 to USD 1450 PMT CFR Mersin.

Indian 2017 crop as anticipated by trade was expected to be lower than average crop of around 325,000 MT whereas speculators on lower and higher side estimated 270,000 MT and 425,000 MT respectively. Farmers were motivated to plant more KCP as the prices doubled in the year fetching them handsome returns but this didn't transform into a Bumper sowing because of following reasons:

1. There was acute shortage of seed with farmers.
2. The cost of seed was very high and everyone expected steep fall in the prices in coming year.
3. Desi Chickpeas posed as a better alternative because its prices increased three times as compared that of KCP, which just doubled.
4. KCP is a sensitive crop and requires good care whereas Desi Chickpeas are more resistant to temperature fluctuations in weather.

Pricing Problem:

Indian crop ended the year 2016 on a very high note trades happened as high as USD 2200 FOB levels, but the market started to come down when the forward sales for March-April shipment was done by Mexican exporters at incredibly low levels of USD 1400 CNF into Turkey. That eventually ruled out the Turks from showing any interest into Indian cargo for sometime. India's biggest buyer Pakistan had already bought enough 7-8-9 mm from Argentina, USA, Canada and Australia. With only MENA (Middle East & North Africa) as its potential buyers, Indians exporters were under immense pressure to make some pre harvest sales to set the ball rolling.

Most of the world pipeline was empty of large caliber chickpeas towards the end of 2016 crop and that was the reason for very good interest/demand from different markets for prompt shipment during February. Thus February forwards opened at a huge premium of INR 2000 (US$ 300) PMT as compared to March. With such huge difference in February and March shipment buyer's across the world either booked March shipment or else waited for February shipment prices to come down.

Speculation in the local market was at its peak during January and February. The forward market opened at INR 96000 PMT ex-factory Indore for 44/46 for March Delivery and moved quickly to INR 110000 PMT as the bulls overpowered the market. During the first half of February, as the arrivals started increasing traders felt the pressure of crop, and with negligible pre-harvest sales bears got the upper hand and market crashed to INR 90000 PMT in a week's time. This was the time when everyone believed that the crop is going to be huge. The market was stable for around a week and then after February 28, 2017 it started to increase and increased upto INR 125000 PMT ex-factory Indore in a month's time. The sudden and sharp increase in prices of KCP can be attributed to following reasons:

1. Arrivals remaining stagnant below 4000 MT.
2. Good demand from all the destinations for ready shipment.
3. Delay in harvest of Mexican crop because of rains in February.
4. Early Ramadan, starting in May end.
5. India has much less transit time to most consuming countries as compared to Mexico.
6. Empty World pipeline.
7. Higher Ocean Freight.
8. Local short covering and speculative buying pushed the prices north.
9. Indian Rupee appreciated broadly by 5% in two months making the exports pricing dearer.
10. Locally a lot of cargo sold for March/April delivery at lower price is still undelivered, Therefore exporters who had to perform, bought new cargo at higher prices and delivered creating fresh demand.

The Road Ahead

The KCP prices have already touched a high of INR 132000 PMT but failed to sustain at these levels and thereafter it has seen a steady decline in prices with some upward corrections in between. It has touched a low of INR 114000 PMT and now trading at INR 117000-118000 levels.

It is very difficult to find out various crop statistics in India. Therefore we don't have any estimates about planted area, crop planted, average yield etc. Hence the only rightful tool, which remotely indicates the size of the crop, is the daily arrivals in the market. Till May 15, 2017 farmers into market had brought approximately 150,000 MTS of KCP whereas last year till the same time total arrivals were recorded to be around 130,000 MTS. It indicates that this year we have received 20,000 MT more KCP as compared to last year. Now the most important point worth noticing is that this year both the crops Kharif and Rabi were delayed by 20-30 days due to late arrival of Monsoons. Despite starting with a delay of 20-30 days the total arrivals this year has already beaten last year's arrival by a decent margin of 20,000 MT, which makes one thing for sure that we definitely have a fairly bigger crop this year as compared to 2016. The arrivals in the market are holding up so far at 1500-1800 MT per day, which is also higher compared to last year still the markets are holding up because of good and consistent demand from Turkey and Algeria.

Last year the Desi Chickpeas price was very high and supported the rise in KCP prices to a large extent. The Desi prices were so high that most of the small size KCP went for crushing as a replacement for Desi Chickpeas. This year all the pulses except KCP are under pressure so the domestic demand could be switched to some extent to cheaper substitutes. Also the mango crop is very good and it decreases the pulses consumption during summer season.

So the key to rise or fall in the price of KCP largely depends on International Demand. Till now the Ramadan demand from Middle East and Algeria is pretty good. The Turkish import duty (20%) relief till June 30, 2017 is also one of the reason good demand from Turkey. Most of the Turkish importers intend to buy for rest of the year and receive goods before June 30, 2017. It gives them a 20% edge over any goods arriving after June.

KCP prices may see a downward trend after May when the Turkish and Algerian demand cools down. The traders have to be really cautious moving ahead into the year as KCP crops from Turkey, Russia, Spain and Morocco will be harvested in June/July and later in the year USA and Canada will be harvested in October/November followed by Argentina in December. This will certainly boost the availability of KCP in the World market. Although the markets are not going to see free fall in prices but there will definitely be gradual softening towards INR 110000 PMT levels, at these levels we may witness some position based buying for coming months because even now there is hardly any stocks in the hand of importers in various countries.

Chick Peas Goodness

Naaznin Husein
President- Indian Dietetic Association, Mumbai Chapter
Founder- Freedom Wellness Management

Chickpeas (Cicer arietinum L.), commonly known as garbanzo beans, Legume family have traditionally been incorporated into many culinary creations because of their nut-like flavour and versatile sensory applications in food.

Global Cuisines

Globally, chickpea is mostly consumed as a seed food in several different forms and preparations are determined by ethnic and regional factors. Two main varieties of chickpeas exist: the light seeded Kabuli type and the smaller dark Desi type

Understanding cuisines is extremely delectable and in the Indian subcontinent, chickpea is split (cotyledons) as 'dal' is a daily staple in almost every Indian Household comprising of Sumptuous recipes like Tadka dal, Ghiya Chana Dal or Turiya Chana Dal.The Dal is also added to the Non vegetarian Foods Like Kebabs and some traditional recipes like Dhanshak and Dal Ghosht are every foodies delight.

The Dal further grounded to make flour ('Besan') that is used to prepare different snacks like Pakoda, Dhokla, Khandvi, Sev, Bhujia, Fafda and Farsans or savoury snacks and Indian MITHAIS like Besan ladoos and Motichoor Ladoos.

The Chick pea as a whole is used creatively in boiled or curry preparations like the world famous Chana Masala or Traditional served as Chole Bhature.

In other parts of the world, especially in Asia and Africa, chickpea is used in stews and soups/salads, and consumed in roasted, boiled, salted and fermented forms. In Mediterain and Turkish and Middle European cultures, chickpea consumption is somewhat driven through the intake of hummus. Traditional hummus is a dip or spread made from cooked, mashed chickpeas, blended with tahini, olive oil, lemon juice, and spices

Nutritional Information

You will find it Fascinating to know ,Chickpea is a good source of carbohydrates and protein, together constituting about 80 % of the total dry seed mass. Chickpea being plant based food is cholesterol free and is a good source of dietary fibre (DF), vitamins and minerals

Protein power

Pulses are unique in comparison to other plant foods in that they contain higher proportions of protein (17%–30% by dry weight). The main proteins found in chickpeas, similar to other legumes, are albumins and globulins. Smaller amounts of glutelins and prolamines are also Chickpea has significant amounts of all the essential amino acids except sulphur-containing amino acids, which can be complemented by adding cereals to the daily diet.

It is interesting that often traditional eat this combination by default .To Illustrate some Popular examples are

- Dal and Rice
- Chana Kulche
- Dal Pakhwan
- Chole Pulao
- Parsee Dhanshak
- Chole and Bhature
- Kadhi Khichdee
- Dal Bhatti Churma
- Hummus with pitta Bread
- Dal Ghosht eaten with Roti or rice

Good Carbohydrates from Chick peas

Starch is the major storage carbohydrate followed by dietary fibre, oligosaccharides and simple sugars such as glucose and sucrose in chick peas

Although lipids are present in low amounts, chickpea is rich in nutritionally important unsaturated fatty acids such as linoleic and oleic acids. b-Sitosterol, campesterol and stigmasterol are important sterols present in chickpea oil. Ca, Mg, P and, especially, K are also present in chickpea seeds.

Chickpea is a good source of important vitamins such as riboflavin, niacin, thiamin, folate and the vitamin A precursor b-carotene. As with other pulses, chickpea seeds also contain anti-nutritional factors which can be reduced or eliminated by different cooking techniques.

Potential Health Benefits

Chickpea has several potential health benefits, and, in combination with other pulses and cereals, it could have beneficial effects on some of the important human diseases such as Cardio Vascular Disease, type 2 diabetes, digestive diseases and some cancers. Overall, chickpea is an important pulse crop with a diverse array of potential nutritional and health benefits.

Weight Control

In general, diets high in fiber, low in energy density and glycemic load, and moderate in protein are thought to be particularly important for weight control . Pulse consumption, alone or included in a dietary pattern has also been associated in epidemiologic studies with **reduced body weight, waist circumference, and risk of overweight and obesity**. Consumption of chickpeas/hummus has additionally been suggested as affecting markers of both metabolic syndrome and cardiovascular disease in both human and animal intervention studies (discussed below).

Glucose and Insulin Response

Some research has documented Chickpeas have a low Glycemic index, however, very few studies have assessed the Glycemic effects of hummus in vivo.

Other human intervention studies have shown pulses to lower Glycemic responses by slowing the rate of carbohydrate absorption when compared to an isoglucidic standard like bread. Likewise, emerging epidemiological evidence shows that pulse consumption is associated with a decreased risk for type-2 diabetes

Cardiac Health

Chickpea seeds are a relatively cheap source of Dietary Fiber and bioactive compounds (e.g. phytosterols, sapiens and oligosaccharides); coupled with its low glycaemic index (GI), chickpea may be useful for lowering the risk of Cardio Vascular Disease (CHD). Chickpea has a higher total DFC (about 18–22 g) compared with wheat (about 12·7 g) and a higher amount of fat compared with most other pulses or cereals. However, two PUFA, LA and OA, constitute almost about 50–60 % of chickpea fat. Intake of PUFA such as LA (the dominant fatty acid in chickpea has been shown to have a beneficial effect on serum lipids, insulin sensitivity and haemostatic factors, thereby it could be helpful in lowering the risk of CHD.

"As The Food –So The mind, As the mind so the man"

Improved Fat Metabolism

Some research has also reported that Chickpea consumption on a regular basis, daily for 6 weeks may decrease fat accumulation in obese subjects. This aids in improving fat metabolism and could be helpful in correcting obesity-related disorders. More Evidence based research may help us understand the exact mechanisms of fat reduction and chick pea's consumptions

Increased Satiety and fullness and Prebiotics

Intake of foods, which are rich in Dietary Fiber (DF), is associated with a lower Body Mass Index. Eating of foods with a high fibre content helps in reaching satiety faster (fullness post-meal), and this satiating effect lasts longer as fibre-rich foods require a longer time to chew and digest in the intestinal system which translates in less food, lower intake of food and hence lesser calories resulting in weight loss because of the Calorie deficit.

Chickpea is a low Glycemic Index (GI) food is 10.Chickea adds to the prebiotic value. Research supports consumption of low-Glycemic Index foods resulted in an increase in cholecystokinin (a gastrointestinal peptide and hunger suppressant) and increased satiety. Diets with low-GI foods resulted in reduced insulin levels and higher weight loss compared with those with higher-GI foods.

Gutt Health

Some research studies revealed an overall improvement in bowel health accompanied by an increased frequency of defecation, ease of defecation and softer stool consistency while on a chickpea diet compared with a habitual diet. Dietary Fiber from chickpeas promote laxation/ bowel function by aiding in the movement of material through the digestive system.

In some individuals Consumption of Chickpeas or dal may give rise to Flatulence.A good tip is to soak the pulse overnight and discard the water. Pressure cook well. Consume during the day at mid morning , lunch or evening snack. Avoid the recipe at dinner time if Flatus persists.Increase physical exercise like walking and yoga may help relief gas and bloating

Bio Actives

Other health benefits Chickpea seed oil contains different sterols, tocopherols and tocotrienols. These phytosterols have been reported to exhibit anti-ulcerative, anti-bacterial, anti-fungal, antitumor and anti-inflammatory properties coupled with a lowering effect on cholesterol levels.

D7 -Avenasterol and D5 -avenasterol, phytosterols present in chickpea oil, have antioxidant properties even at frying temperatures. Carotenoids such as lutein and zeaxanthin, the major carotenoids in chickpea seeds, are speculated to play a role in senile or age-related macular degeneration. Though there are some epidemiological and association studies suggesting a beneficial effect of lutein and zeaxanthin on age-related macular degeneration like Alzheimer's and Parkinson's. Carotenoids have been reported to increase natural killer cell activity. Further research, especially well-conducted Randomised Control Trials, needs to be performed to provide compelling evidence for the direct health benefits of chickpea consumption

Conclusions

There is potential nutritional importance of chickpea and its role in improved nutrition and health. It is an affordable source of vegetarian protein, carbohydrates, minerals and vitamins, Dietary Fiber, folate, b-carotene and health-promoting fatty acids. Scientific studies have provided some evidence to support the potential beneficial effects of chickpea components in lowering the risk of various chronic diseases, although information pertaining to the role of individual chickpea components in disease prevention and the mechanisms of action are limited to date. This is due to the complex nature of disease aetiology and various factors having an impact on their occurrence. It is imperative that the scientific community continues to unravel the mechanisms involved in disease prevention and determine how food bioactive from foods such as chickpea can influence human health.

Summary

To summarise **"As The Food –So The mind, As the mind so the man"**. Eating mindfully with complete awareness with an understanding of portion control is important. Whilst the benefits of Chickpeas are many, cooking forms like frying, oil,sugar content may change its nutrition properties and caloric content.

No Diet completes itself without Physical Activity. To attain the required health benefits of any food it has to be effectively combined a daily physical activity. Some Yoga, meditation and exercise are imperative.

So Cheers To HAPPY EATING AND HEALTHY EATING.....

World Pulses Scenario

Brian Clancey
Stat Publishing

World pulse production should be little changed this year because of the record rabi season harvest now underway in India, but there remains a significant risk the output will decline in 2018.

Just as last year's kharif season crop reduced demand for green lentils, this year's increase in desi chickpea output should reduce demand for yellow peas, small kabuli chickpeas and desi type chickpeas during the last half of the calendar year.

Markets are paying close attention to whether India's efforts to encourage continued expansion in pulse crop production will be as successful in the coming production cycle. The fact that commercial markets fell below the minimum support price (MSP) for tur or pigeon pea in several regions suggests farmers may prefer to grow other crops.

India's production goal for all food grains for the coming cycle is little changed from this season's. The 273 million metric ton target is up one million tons from the latest estimate for 2016-17. Even so, there is a growing belief pulse production will fall sharply.

Policies aimed at boosting pulse production in 2016-17 were effective. But, the follow up has been less so. Many farmers have sold much of their crop below the MSP, creating a disincentive to maintain output.

Imposing a 10% import duty on tur or pigeon pea was intended to boost prices paid to farmers but product from two of India's key suppliers enters duty free under other trade agreements. Once the bulk of the desi chickpea crop starts to enter markets, there is a risk similar action could be taken with other pulses, including desi chickpeas from Australia and yellow peas from Canada and other origins.

Such moves would target new crop product from Australia and other suppliers, more so than pulses harvested last year. However, given that India is the most important destination for yellow peas and desi chickpeas, any increase in import duties are more likely to be shared between buyers and sellers, limiting the impact on landed costs.

While returns from pulses remain competitive with other crops, growers outside India appear to be somewhat concerned about the depth of demand in the coming season. Intended seedings of all dry pulses in Canada and the United States has dropped from 14.63 million acres last year to around 12.95 million. While dry edible bean and chickpea area is up, land in lentils and field peas is down. Lentil area could drop over one million acres to 5.44, while pea seedings could drop 500,000 acres to 5.16 million.

If farmer stick with their intentions, average yields would see production drop from 12.33 to 10.56 million metric tons. However, because residual supplies are up sharply from last year, the available supply of pulses may only be down 257,000 metric tons at 13.27 million.

To the extent demand from India is muted during the last half of the calendar year, prices for pulses could trend lower through at least December. Price direction in 2018 will be determined in large measure by the extent to which lower prices increase demand from countries such as China and the impact they have on rabi seedings on the Indian subcontinent.

If those decline as expected, demand for pulses for arrival after December would be expected to improve, which could add important support to prices. This suggests prices could set their season lows for 2017-18 before November or December, and trend upward in 2018, depending on the pace of buying interest.

Dry pulse production in Canada is also facing some long term challenges. In Manitoba there is a clear trend that is seeing farmers switch from dry pulses and other field crops to soybeans. This is starting to gain some traction in Saskatchewan. In Manitoba, field pea area is expected to sink from 165,000 to 40,000 acres while virtually no lentils will be grown. Instead, farmers say they will plant a record 2.2 million acres of soybeans, up from 1.64 million last year.

There is still more upward potential for soybean area in Manitoba, but provincial agronomists think it is limited. On the other hand, Saskatchewan has not reached its upper limit for the crop. More importantly, ongoing plant breeding efforts suggests the acreage potential for the province will increase further over the coming decade.

Farmers in Saskatchewan intend to plant 730,000 acres this year, up from 230,000 last year. That puts then on par with where Manitoba was in 2012, when seeded area jumped from 575,000 acres in 2011 to 800,000.

Just as was the case in Manitoba, gains in soybean area will come at the expense of dry pulses and other crops. Aphanomyces has become a significant problem in the province because farmers have been pushing lentil and field pea rotations.

At the present time, the only way to defeat the disease is to wait

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six and eight years before planting peas, lentils or alfalfa on the same land. To keep pulses in a three to four year rotation, farmers need to include soybeans, fababeans, or chickpeas. Those crops have good resistance to the disease.

Manitoba has the potential to approach three million acres of soybeans annually or about a third of the cropped land. Getting there would require another major shift in crop choices.

Saskatchewan has the land to plant more soybeans than Manitoba, suggesting western Canada will one day grow more soybeans than eastern Canada. But, that will also require a significant shift in what farmers grow. As soybean area expands, growers in that province will also face problems controlling volunteer Roundup Ready canola.

For India, security of supply for pulses is paramount. But current policies might not be strong enough to sustain production at high levels, while growers in net exporting countries are starting to explore other options in the face of marketing and agronomic pressures.

Area (acres)	2014	2015	2016	2017	5-year aver
Lentils	3,401,000	4,528,000	6,793,000	5,440,000	3,395,000
Peas	4,944,000	4,857,000	5,659,000	5,156,000	4,244,000
White Beans	463,000	390,000	340,000	364,000	403,000
Colored Beans	1,328,000	1,427,000	1,335,000	1,335,000	1,219,000
Chickpeas	395,000	331,000	503,000	656,000	360,000
Total	10,531,000	11,533,000	14,630,000	12,951,000	9,620,000
Production (MT)	2014	2015	2016	2017	5-year aver
Lentils	2,765,000	3,370,000	4,506,000	3,624,000	2,594,000
Peas	4,599,000	4,042,000	6,116,000	5,045,000	3,987,000
White Beans	404,000	350,000	291,000	329,000	350,000
Colored Beans	1,053,000	1,142,000	1,084,000	1,094,000	979,000
Chickpeas	256,000	204,000	332,000	470,000	260,000
Total	9,077,000	9,108,000	12,329,000	10,562,000	8,170,000
Carry In (MT)	2014	2015	2016	2017	5-year aver
Lentils	1,086,000	630,000	651,000	1,287,000	1,000,000
Peas	384,000	774,000	354,000	1,315,000	465,000
White Beans	22,000	57,000	45,000	16,000	57,000
Colored Beans	121,000	133,000	144,000	86,000	138,000
Chickpeas	100,000	90,000	2,000	2,000	55,000
Total	1,713,000	1,684,000	1,196,000	2,706,000	1,715,000
Supply (MT)	2014	2015	2016	2017	5-year aver
Lentils	3,851,000	4,000,000	5,157,000	4,911,000	3,594,000
Peas	4,983,000	4,816,000	6,470,000	6,360,000	4,452,000
White Beans	426,000	407,000	336,000	345,000	406,000
Colored Beans	1,174,000	1,275,000	1,228,000	1,180,000	1,117,000
Chickpeas	356,000	294,000	334,000	472,000	315,000
Total	10,790,000	10,792,000	13,525,000	13,268,000	9,885,000
BASED on data from Statistics Canada and USDA. Forecasts by STAT Publishing Panama.					

Pulses – The Extraordinary Year

Bharat Kulkarni

The year of 2016 was a important year for pulses worldwide. The 68th UN General Assembly had declared 2016 as the International Year of Pulses and nominated the Food and Agriculture Organization of the United Nations (FAO) to facilitate the implementation of the Year in collaboration with Governments, relevant organizations, non-governmental organizations and all other relevant stakeholders. The aim of the IYP 2016 was to heighten public awareness of the nutritional benefits of pulses as part of sustainable food production. The Year also aimed at addressing various issues to the trade of pulses.

However, India, the Big Daddy of the global pulses market, responded to it in its own different way. After the volatile years in 2015 and 2016,which were marked with reduced production, supply shortfall, challenges in availability, leading to high consumer prices and increased imports, a lot of hope was needed. Not only the business, but the government was also looking at it very eagerly and had pinned a lot of hopes on the 2016-17 season, especially with curtail elections to be held.

The year in India started with a expectation of a normal monsoon. With the monsoon being normal, in some cases better than average, the ample rains across India resulted in a five-year high level of planting of pulses thereby, raising expectations of a bumper crop, The expectation was that it would be helpful in cooling down soaring prices and tame food inflation. The industry was hoping that the size of the crop in India would be massive and will have a extraordinary year for pulses in 2016-17.

As the kharif season picked up and the rains started to confirm the expectation, the Industry started to brace itself for huge crop output in India with estimates going to the level of 20 million tons. The country was sure to produce the quantity it required for its domestic consumption. This was against a very weak backdrop, as the two years of challenges had pushed the dependency on imports to a new high. The previous peak output was in year 2013-14 at a level above 19 million tons. In such a backdrop, production level of 20 million tons was extraordinary. Clearly, the country was set to see an extraordinary year of pulses. As the kharif season ended with a level of 9.12 million tons, with a rise of about 60% over last year, the news was confirmed. India produced about 4 million tons more in 2016-17 as compared to last year in Kharif season alone.

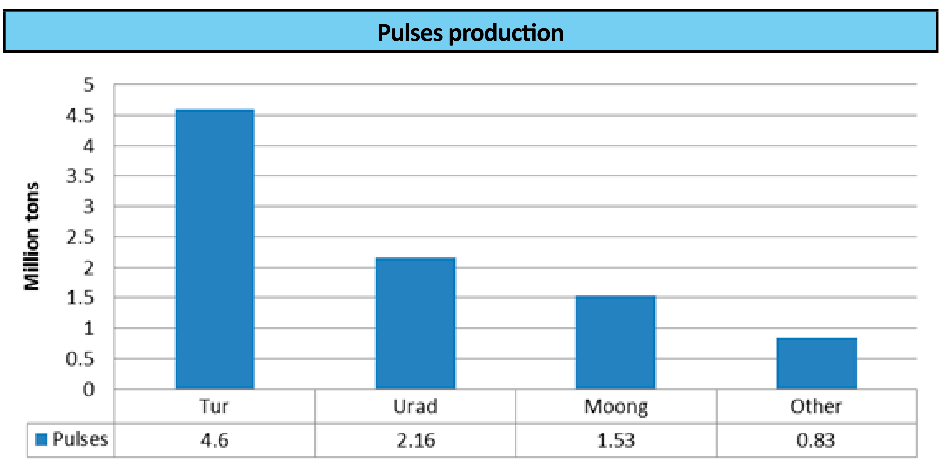

Fig1: Production of pulses in kharif season

The rise in pulses production was mainly due to the normal to near normal monsoon and a significant rise in the area under cultivation for pulses. The government reports in august 2016 indicate that the area coverage under Kharif Pulses was higher by 3.55 million ha. As compared to 2015-16 and compared to the average coverage was 3.8 million ha higher. This was due to higher coverage in Tur, Urad and Moong.

The same trend was followed by the Rabi crop as well. The area under the cultivation for pulses under the Rabi Season was over 16 million hectares. This was about 2 million hectares more than the normal or five-year average area. The news is now confirmed. Pulses in India has seen an extraordinary year.

The third advanced estimates released by the ministry of agriculture recently have indicated that the production of Rabi Pulses in India is estimated to be 13.29 million tones. This is close to 2.47 million tones more than the production in 2015-16. The major production in rabi is of gram. It is estimated that the total production of gram will be more than 9 million tons. This is about 2 million tons more than 2015-16.

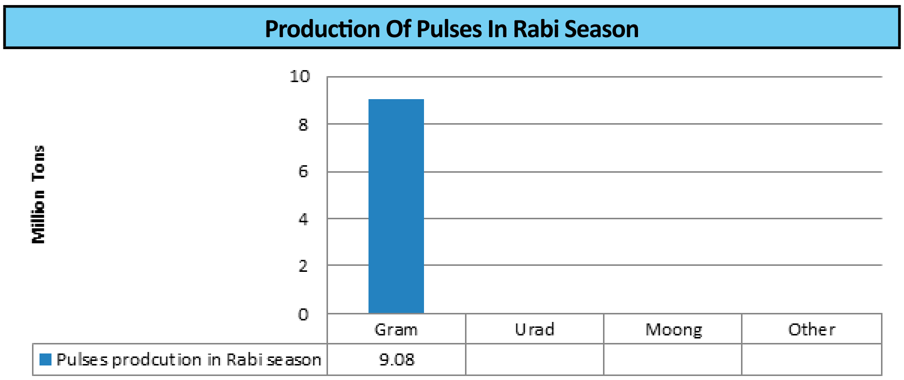

Fig 2: Production of pulses in rabi season

Overall, as against 16.36 million tons of pulses being produced in India in 2015-16, The country will produce about 22.4 million tons, about 37% more. The country has produced the quantity required for its estimated consumption. India's estimated consumption of pulses has been identified as 22 million tons. Does it means India is self sufficient?

Pulses production in India 2016-17 (million tons)			
Pulses	**Kharif**	**Rabi**	**Total**
Tur	4.6	0	4.6
Gram		9.08	9.08
Urad	2.16	0.76	2.92
Moong	1.53	0.54	2.07
Other	0.83	2.9	3.73
Total production	**9.12**	**13.28**	**22.4**

As the country was witnessing the steep rise in production, same time the imports also were rising. India imported more than 5 million tones already by December and the imports are not going down in the same proportion as the increase of production. This is a new dimension in the pulses market of India. If the volatility in the prices continue and the farmers do not realise the prices anticipated, 2017-18 can again see a steep rise in imports and pulses market to continue the bumpy ride.

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Australian 2017-18 Pulse crop prospects

Nick Goddard
CEO, Pulse Australia

With farmers beginning to plant their 2017 winter crops, Australia is looking towards another strong season of pulse production in 2017. Based on the Australian Bureau of Agricultural and Resource Economics' (ABARE, the official Australian government forecaster) latest crop report in February 2017, and using average harvest prices, pulses were the second most valuable crop in Australia last year (after wheat). There is growing confidence that Australia's position as a global supplier of high quality, clean and good value pulses will be maintained in the coming season.

While it is a long six to seven months till the 2017-18 crop is harvested in late 2017, early indicators are that area planted to pulses (mainly chick peas and lentils) will increase in 2017/18 in the range of 0-5% at the expense of the lower priced cereals. This is on top of the 31% increase and 9% increase in pulse area reported by ABARE for 2015/16 and 2016/17 respectively.

By now, Australian pulse growers have decided whether to include pulses in their winter cropping rotation or not. There have been a number of key variables at play this year which will have influenced growers' planting intentions.

The variables which are favouring pulse planting in Australia this year include the improved gross margin return versus alternative crops, the growing confidence and expertise amongst pulse growers and the amount of stored moisture in the soil.

The improved gross margins for pulse production in the coming year are driven by both the low prices for the alternate crops of wheat and barley, together with the relatively higher returns for pulses. These conditions have been in play for the past few years, and have been a major factor in growers' decisions to increase the area devoted to pulses.

Combine this variable with more growers introducing pulses into the rotation together with existing pulse growers expanding the area devoted to pulses in recent years, the level of confidence and expertise amongst growers and their advisors has also grown. Even though pulses carry more risk (price and production) than alternatives, the increased knowledge gained in recent years has built confidence amongst growers.

The final positive variable is the amount of stored moisture in the soil. Despite a very hot, dry summer across most of the pulse growing regions, there has been strong recent rainfall in most cropping areas in the lead up to planting.

In contrast to the positive drivers, the variables which growers may consider are not favouring pulses this year include the forecast dry conditions for many growing areas, the relative attraction of canola as an alternative crop, and the shortage of available land for pulses.

The Australian Bureau of Meteorology has the chance of an El Niño forming in 2017 at 50%, which is twice the normal likelihood. El Niño is often, but not always, associated with below average winter–spring (May to Oct) rainfall over eastern Australia. Of the 27 El Niño events since 1900, 18 resulted in widespread dry conditions for parts of Australia. News of this could temper growers' planting intentions for crops with higher risks, such as pulses. While this will also provide caution to canola growers, canola is expected to be more competitive with pulses this year, which might also serve to moderate the final pulse planted area.

The final consideration for pulse growers this season is the farm space available which did not have pulses growing last year. Best practice farming guidelines strongly advise against growing pulses in consecutive years on the same farm land, due to the risk of build up of broadleaf weeds and disease. With such a large planting last year, growers will have to carefully manage their paddock selection to maximise their pulse yield.

In summary, there are a number of pros and cons driving pulse planting intentions in Australia this year. At this early stage, industry observers indicate an area increase of 0-5% over last year, after very strong area growth in the previous two years. One obvious caution for 2017/18 production is that the record yields of 2016/17 are highly unlikely to be repeated and a return to average yields is more likely.

Pulse Australia will issue its first official crop forecast to its members later this month. If you would like to become a member of Pulse Australia and receive regular updates throughout the season about the Australian Pulse crop prospects, then contact Pulse Australia via their website: www.pulseaus.com.au .

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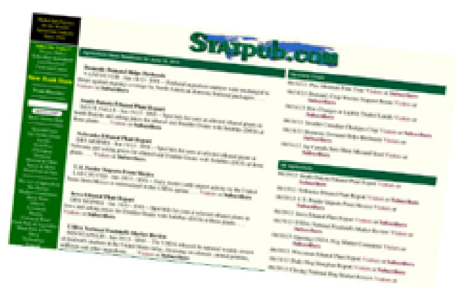

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Canada's Pulse Crop Outlook for 2017

Anya McNabb
Pulse Canada

The 2017 planting season started late for many Canadian farmers. After a wet and challenging harvest season last fall, cool temperatures and persistent soil moisture delayed spring seeding for many producers in Canada's prairie region.

In Saskatchewan and Alberta, where most of Canada's pulse production occurs, some producers are also dealing with 2016 crops that couldn't be harvested before winter hit.

"A lot of farmers still need to get the remainder of their 2016 crop out of the ground before they can put the 2017 crop in," said Allison Ammeter, a pea and faba bean producer from Alberta and member of the Pulse Canada Board of Directors. "We're seeing combines, drills, sprayers and tillage equipment all out at the same time right now."

Last Year's Challenges Affect This Year's Seeding Decisions

Canadian farmers seeded roughly 4.2 million acres of peas and 5.9 million acres of lentils in 2016. Although wet conditions and disease pressure impacted harvest quality and quantity, Canadian pulse production hit a record high last year at 8.4 million tonnes. This year, pulse acreage in Canada is expected to decline by approximately 6% for peas and 25% for lentils according to data published by StatPub on May 10, 2017.

"I believe the forecasted dip in pulse acres is partly a response to the moisture and disease challenges farmers experienced last year, particularly with their lentil crop," explained Lee Moats, Chair of the Pulse Canada Board of Directors. "We're seeing farmers shift some of their acres from grain legumes to oilseed legumes like soybeans, which are more tolerant of wet conditions."

High Production Expected for Canadian Pulse Crops in 2017

High Production Expected for Canadian Pulse Crops in 2017

Despite last year's weather challenges, the production outlook for Canada's 2017 pulse crop is positive because growing conditions are expected to return to normal, which should result in better yields. StatPub estimates Canada will produce roughly 4 million tonnes of peas and 2.7 million tonnes of lentils this year. Canadian chickpea production is also expected to increase this year to 114,000 tonnes, up from 85,000 tonnes in 2016.

The bottom line: even with the forecasted decline in pulse acreage, there will be plenty of Canadian pulses ready for export. Statistics Canada predicts that 2017 will be the second-largest (after 2016) for Canada's pulse industry, both in terms of seeded acres and overall production.

Moats, who farms in Riceton, Saskatchewan, is optimistic about both the 2017 growing season and the future of Canada's pulse industry. "Farmers look at both short-term and long-term profitability," he said. "In the long term, many of us have a strong commitment to pulse crops because they're part of our sustainable production strategy. I can say with relative certainty that when it comes to my farm at Riceton, pulses aren't going anywhere any time soon."

Latest Outlooks Available at Pulses 2017: The Future of Food Convention

Early in the growing season, Canadian supply and demand estimates for pulses are fairly tentative. That's especially true this year because of the late start to planting.

Pulse traders can hear the latest Canadian and global commodity outlooks at Pulses 2017, July 10-13 in Vancouver, Canada. For the first time, the Global Pulse Confederation and the Canadian Special Crops Association are bringing their annual conventions together for the biggest event the pulse industry has ever seen. Vancouver is located on Canada's west coast and offers direct flights to and from many international destinations.

"We'll be able to more accurately report seeded acres and predict yield and production numbers in Canada in late June, once this year's crop is fully in the ground and established," said Colin Topham, President of the CSCA.

Along with updates from market analysts and traders on supply and demand outlooks for this year's pulse crops, delegates will also attend networking events, hear about industry issues and updates, and take in presentations from global food industry experts.

By mid-May, Pulses 2017 was excepting to welcome over 900 delegates from 42 countries to Canada to attend Pulses 2017.

2017 USA Crop Planting & Production Estimates

Shakun Dalal
US Dry Bean Council &
USA Dry Pea and Lentil Council.

The National Agricultural Statistics Services (NASS) published their Prospective Plantings report for Spring of 2017.

Quick Summary: Corn down, Wheat down, Soybeans Up, Cotton up. Winter wheat plantings are the second lowest on record, while Spring wheat plantings are the lowest projections since 1972. Durum wheat plantings are a record low.

What about pulse crops?

ACREAGE FOR TOTAL CHICKPEAS-LARGE AND SMALL SIZE

ALL CP	2015	2016	2017	% Up/Down
California	7,700	10,200	13,000	□27
Idaho	70,000	92,000	115,000	□25
Montana	43,000	99,000	198,000	□100 (Doubled)
Nebraska	200	2,900	3,000	□3
North Dakota	7,400	13,200	19,000	□44
Washington	75,000	108,000	150,000	□39
TOTAL ALL CP	207,500	325,300	498,000	□53

<u>CHICKPEAS</u>

The U.S. chickpea planting projections predict a record high for chickpea acreage for the second year in a row, a 53% increase over 2016! Last year, the U.S. planted 325,300 acres of both large and small chickpeas. In 2017, they will be planting an additional 172,700 acres. That puts U.S. chickpea acreage projections at 498,000 acres!

ACREAGE FOR SMALL CHICKPEAS

SMALL CP	2015	2016	2017	% Up/Down
Idaho	32,000	39,000	50,000	□28
Montana	DID	NOT	REPORT	DNR
North Dakota	5,000	3,800	4,000	□5
Washington	20,000	29,000	45,000	□55
Other States	15,200	42,000	56,000	□33
U.S.	72,200	113,800	155,000	□36

Here's how it breaks down. Note that Montana data is not reported separately, but is included in the "Other States" category. **Small chickpeas are up 36%, but large chickpeas are up 62%, with an average chickpea increase of 53% in the U.S. California is starting to grow a lot of large chickpeas, by the way, increasing their acreage by 27%.** In 2015, they grew 7,700 acres. Two years later, they plan to plant 13,000 acres, just two thousand acres shy of North Dakota intentions. However, the real eye opener here are the "Other States" category – a projection of 142% increase in large chickpea acreage!

ACREAGE FOR LARGE CHICKPEAS/GARBANZOS

LARGE CP	2015	2016	2017	% Up/Down
California	7,700	10,200	13,000	□27
Idaho	38,000	53,000	65,000	□23
Montana	DID	NOT	REPORT	DNR
North Dakota	2,400	9,400	15,000	□60
Washington	55,000	79,000	105,000	□33
Other States	28,800	59,900	145,000	□[illegible]
U.S.	135,300	211,500	343,000	□62

The big increases come in Montana, Idaho and Washington, so the question to ask is, if they're planting this much chickpea seed, what crops are they not planting? In these areas, it's safe to say that wheat is taking the biggest hit, but other pulses are on the chopping block as well.

2017 TOTAL CHICKPEAS PRODUCTION ESTIMATES

Using the harvested acres/planted acres ratio and 10 year average yields, we can make an early prediction on 2017 chickpea production-

SMALL CHICKPEAS	2016	2017	% Change
U.S. Production (MT)	74,556	99,066	+33

LARGE CHICKPEAS	2016	2017	% Change
U.S. Production (MT)	151,941	223,204	+47

<u>LENTILS</u>

Frankly, lentil acreage isn't bad either. In fact, if realized, these numbers represent a record high for lentil plantings in the U.S. The U.S. is projected to pass the 1-million-acre mark with a 13% increase in lentil acreage. Montana and Washington are both increasing lentil acreage, and if you look at the last two years, Montana has become a rock star when it comes to planting lentils. 2017 represents a record high for Montana as well. Idaho and North Dakota have cooled on lentils a bit, but acreage still remains strong in all of the pulse growing states.

2017 LENTILS ACREAGE ESTIMATES

LENTILS	2015	2016	2017	% Up/Down
Idaho	33,000	38,000	35,000	-8□
Montana	235,000	520,000	640,000	□23
North Dakota	165,000	305,000	300,000	-2□
Washington	60,000	70,000	80,000	□14
U.S.	493,000	933,000	1,055,000	□13

2017 LENTIL PRODUCTION ESTIMATES

Using the harvested acres/planted acres ratio and 10 year average yields, we can make an early prediction on 2017 lentil production-

LENTILS	2016	2017	% Change
U.S. Production (MT)	575,387	571,454	-0.5

DRY PEAS

With chickpea acreage shooting to the stars, and lentil acreage on the rise as well, it is no surprise that at least one pulse crop is projected to take a hit in acreage. With dry pea prices lower than normal this year, dry pea acreage is likely to decline in Montana, North Dakota and Washington. Idaho and newcomers South Dakota are holding the torch, however, by increasing their acreage slightly.

If you look at the 2015 column, you'll see that dry peas have a bit of catching up to do. It really comes down to price. Lentils and Chickpeas have been very solid in the Pulse Market News for the last three years. Will this mean rising prices for dry peas as production volumes decrease? Time will tell.

2017 ACREAGE ESTIMATES FOR DRY PEAS

DRY PEAS	2015	2016	2017	% Up/Down
Idaho	51,000	29,000	30,000	□03
Montana	595,000	610,000	460,000	-25□
North Dakota	385,000	560,000	500,000	-11□
South Dakota	N/A	32,000	35,000	□09
Washington	105,000	90,000	65,000	-28□
U.S.	1,143,000	1,382,000	1,141,000	-17□

2017 DRY PEAS PRODUCTION ESTIMATES

Using the harvested acres/planted acres ratio and 10 year average yields, we can make an early prediction on 2017 dry pea production-

DRY PEAS	2016	2017	% Change
U.S. Production (MT)	1,255,911	912,060	-27

AUSTRIAN WINTER PEAS

Idaho was the largest grower of AWP in the U.S. in 2016. However, Idaho acreage for AWP has declined quite a bit. Since Montana's AWP has stayed the same, it is the largest AWP producer for 2017 if these numbers hold.This winter pulse variety, grown primarily for their rotational benefits and for feed has declined by 32% in the U.S. overall.

2017 ACREAGE ESTIMATES FOR AUSTRIAN WINTER PEAS

AWP	2015	2016	2017	% Up/Down
Idaho	13,000	18,000	6,000	-66□
Montana	15,000	15,000	15,000	--
Oregon	6,000	5,000	5,000	--
U.S.	34,000	38,000	26,000	-32□

CONCLUSION

If these acreage projections hold, total pulse acreage will increase in the United States in 2017 by a little less than 2%. Chickpeas and lentils will see large increases overall (respectively), while dry pea plantings will decline. Could this projection change? Since these NASS figures are based solely on reports of pulse farmer's intentions, and expect a sampling error of 1-3 percent, they certainly can. And, people change their minds. It is possible that reading these NASS projections alone has a few farmers on the fence. The USA Dry Pea and Lentil Council is currently conducting their own industry-wide survey and will publish the results in a future edition of the Pulse Pipeline.

2017 ACREAGE ESTIMATES FOR ALL PULSES IN USA

2017 U.S. Dry Pea, Lentil and Chickpea Acreage

U.S. Pulses	2015	2016	2017	% Up/Down
Chickpeas	207,500	325,300	498,000	□53
Lentils	493,000	933,000	1,055,00	□13
Dry Peas	1,143,000	1,382,000	1,141,000	-17□
AWP	34,000	38,000	26,000	-32□
TOTAL	**1,877,500**	**2,678,300**	**2,720,000**	**□2**

PULSE SEEDING PROGRESS IN USA

PACIFIC NORTHWEST

According to the USDA NASS, an average for the state, the Palouse region has had more than their fair share of precipitation. USDA reports that the Moscow / Pullman area had 4 days of rain last week, for an accumulation of .38 of an inch. Not terrible, but not great since sunshine is what the area needs to dry out the fields (which have already received 20 inches of rain for the season). **Regardless, some growers ventured into the fields this week. In Idaho, 3% of the projected dry pea acreage was planted, down a bit from the 6% of last year, but well below the 5-year average of 16%. In Washington State, 6% planted compared to 37% last year and a 30% 5-year average. Oregon faired a bit better, with 55% of their dry peas planted, well above last year's 6%. USDA did not publish stats for lentils or chickpeas.**

In Walla Walla, Washington, Gary Ferrel of Blue Mountain Seed says the sun is shining and tractors are busy in the fields. He projects that 70% of the green pea seed is in the field, while about 10% of the garbanzoss are planted. "Our growers are making good progress," said Gary with a hint of optimism in his voice. "We have a lot of mud... not ideal conditions, but guys are putting seed in the ground regardless."

NORTHERN PLAINS

Montana has had "spring-like" temperatures with scattered rain, according to the USDA-NASS report, with a few days suitable for field-work. **They report dry peas, mainly yellows as being roughly 9% planted compared to last year's 35% and lentils at 1% planted compared to 17% last year.** Brian Gion, the Marketing Director for the Northern Pulse Growers Association reports that today about 10-15% of the pulses (mainly yellow peas and lentils) are planted in the eastern Montana and the Williston, ND area. There might be a few acres here and there planted in other areas of North Dakota, says Gion. Soil temps are still cool and the area still has damp conditions. The next 7-day forecast is calling for cool and wet conditions as well. The Fort Benton and Big Sandy, MT area is about 25% planted and further west from there, Gion reports that about 10-15% are planted.

Mark Hardy is busy planting green peas at his Hardy Farms operation in Beach, North Dakota. "Conditions are good for planting, but we could use some rain soon," Mark commented. "We're fairly cool and dry, but have rain forecasted next week." Mark says he is about 40% finished with the peas and has not planted lentils yet.

An Overview Of Chickpea Research: From Discovery To Delivery

Mahendar Thudi[1], Manish Roorkiwal[1], Himabindu Kudapa[1], Sushil K Chaturvedi[2], Narendra P Singh[3], Rajeev K Varshney[1]

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Rapid changes in climate coupled with population explosion and limited arable land are the greatest challenges before the humanity in attaining future food and nutritional security across the globe. In this context, being rich in grain protein, food legumes play an important role in reducing hunger and malnutrition especially in developing countries along with major cereals like maize, rice and wheat. Among more than a dozen legumes, chickpea (*Cicer arietinum* L.), a cool season crop, is the most important food legume in India. It is a self-pollinated crop with a basic chromosome number eight and a 738 Mb genome size (Varshney et al. 2013a). Based on seed market type, chickpea is classified into two groups namely *desi* and *kabuli*. Anthocyanin pigmentation can be seen on one or other parts of the desi chickpea whereas anthocyanin pigments are absent in *kabuli* types. Grains of *desi* chickpea are small in size, light to dark brown in color and have a thick seed coat. Grains of *kabuli* chickpea are bigger in size, have a whitish-cream color and thin seed coat. The *desi* type is more prominent and accounts up to 80% of global chickpea production. Chickpea is a highly nutritious grain legume crop and is one of the cheapest sources of protein. It is an important source of energy, protein, soluble and insoluble fiber. Further, the seed protein contains essential amino acids like lysine, methionine, threonine, valine, isolucine and leucine. On an average, chickpea grains contain 60-65% carbohydrates, 6% fat, and between 12% and 31% protein – higher than any other pulse crop. It is also a good source of vitamins (rich in B vitamins) and minerals like potassium and phosphorus. Chickpea like other legume crops also replenishes soil fertility through biological nitrogen fixation.

Chickpea is grown mostly in South Asia and Sub-Saharan Africa, which accounts for more than 75% of the world chickpea area. Global chickpea production has increased from 7.68 million tonnes (1961) to 13.73 million tonnes (2014) (FAOSTAT, 2016). India ranks first in terms of cultivated area and production. However, there is a slight increase in the chickpea cultivation area in India from 9.27 million hectares (1961) to 9.92 million hectares (2014), but production increased significantly from 6.25 million tonnes (1961) to 9.88 million tonnes (2014) due to significant increase in the productivity from 0.67 t/ha (1961) to 0.99 t/ha (2014). Other major chickpea producing countries are Australia (629,400 tonnes), Myanmar (562,163 tonnes), Ethiopia (458,682 tonnes), Turkey (450,000 tonnes), and Pakistan (399,030 tonnes) (2014) (FAOSTAT, 2016).

Chickpea has a long history of research in India. It started as early as 1905, when formerly Imperial Agricultural Research Institute, Pusa (now known as Indian Agricultural Research Institute (IARI)) made a modest beginning by taking up breeding work on chickpea. Systematic research on chickpea started with the establishment of the All India Coordinated Pulses Improvement Project (AICPIP) in 1967 (http://www.aicrpchickpea.res.in). In 1972, CGIAR, an international body established ICRISAT with a global mandate of crop improvement of select dryland crops including chickpea. ICRISAT started working globally as well as with ICAR and other partners in India. Realizing the importance of crop and providing focused attention on every aspect of chickpea, ICAR established a separate All India Coordinated Research Project (AICRP) on Chickpea in 1993. ICRISAT and ICAR have been working very closely for more than 40 years. More than 190 chickpea varieties for important traits have been released in India (Chaturvedi et al. 2016). In this article we provide an overview of chickpea research and highlight some research activities in chickpea research undertaken by ICRISAT and its partners during last 10 years or so. These activities are contributing to develop climate resilient chickpeas for ensuring food and nutritional security in India and across the globe.

Narrow genetic base in the cultivated genepool of chickpea and the complex nature of the abiotic and biotic stresses kept the productivity less than 1 t/ha^{-1} for several decades. In addition, enhanced occurrences of abiotic (drought, heat, salinity, frost etc.) and biotic (Fusarium wilt, Ascochyta blight, insect pest, nematodes) stresses also contributed to significant production losses. During the last decade conventional breeding efforts coupled with genomics-assisted breeding (GAB) (Varshney et al. 2005, 2007) demonstrated enhanced yields in cereals like rice by minimizing losses due to biotic and abiotic stresses. In order to attain faster genetic gains, the availability of genomic resources and their deployment in breeding programs is a prerequisite. Although chickpea was considered as “orphan legume”, recent research efforts globally transformed it to a genomics resource rich crop. Several thousands of molecular markers (Nayak et al. 2010), high density genetic maps (Thudi et al. 2011; Gujaria et al. 2011; Jaganathan et al. 2014; Kale et al. 2015), transcriptomic resources (Varshney et al. 2009; Hiremath et al. 2012; Kudapa et al. 2014) and physical map (Varshney et al. 2014a) are now available for trait dissection and crop improvement. In recent years, genetics of complex abiotic stresses like drought (Varshney et al. 2014b), heat (P. M. Gaur, personal communication), salinity (Vadez et al. 2012; Pushpavalli et al. 2016) and biotic stresses like Fusarium wilt, Ascochyta blight (Sabbavarapu et al. 2013) have been understood and the genomic regions/QTLs have been identified. Furthermore, several functional genomics approaches such as RNA-seq, Massive Analysis of cDNA Ends (MACE) with parental genotypes of mapping populations as well near isogenic lines (NILs) have provided some candidate genes for drought tolerance that are being validated through genetical, genomics and/or TILLING approaches.

In 2013, International Chickpea Genome Sequencing Consortium (ICGSC http://ceg.icrisat.org/gt-bt/ICGGC/ICGSC.htm) co-led by ICRISAT, University of California-Davis (USA) and BGI-Shenzhen (China) assembled the draft genome of *kabuli* chickpea genotype CDC Frontier, while Next Generation Challenge Programme on Chickpea Genomics (NGCPCG), India assembled genome sequence of *desi* genotype ICC 4958. After assembling the draft chickpea genomes, efforts to exploit the potential of next generation sequencing (NGS) technology to understand the genome architecture of chickpea were initiated. As part of these initiatives NGS based whole genome re-sequencing (WGRS) of chickpea parental lines were undertaken, which led to identification of 2 million Single Nucleotide Polymorphisms (SNPs) and more than 290K Indels. These SNPs are valuable resource providing enough markers to undertake the genetics research (Thudi et al. 2016a). In addition, NGS based WGRS was used to understand the impact of breeding on genetic diversity and temporal diversity trends in chickpea. For this, WGRS was used to re-sequence more than 100 chickpea varieties released in last five decades and identified 1.2 million SNPs. These SNPs were used to identify the genomic changes during the history of chickpea breeding suggesting increase in diversity in the primary gene pool as result of recent chickpea breeding programs (Thudi et al. 2016b). In addition to parental lines and varieties, chickpea reference set (comprising 300 accessions) were also re-sequenced using WGRS approach and led to identification of 4.9 million SNPs. These SNPs are being used to undertaking the genome wide association study (GWAS) for identifying the markers associated with traits of interest and understanding the domestication and post domestication divergence in chickpea (unpublished data). Global genebanks store the huge germplasm wealth that has the potential to contribute significantly towards the goal of enhancing the rate of genetic gain. In order to exploit the potential of genebanks, ICRISAT along with its partners have launched the large scale resequencing initiative “The 3000 Chickpea Genome Sequencing Initiative” to re-sequence 3000 lines from Global Chickpea Composite Collection (Varshney, 2016). This is the first time in the chickpea research history that 3000 lines have been evaluated at six different locations in India for two seasons for several traits of agronomic importance.

The genomic resources generated have been successfully deployed for developing superior lines for different traits of interest. Trait mapping and molecular breeding such as marker-assisted backcrossing (MABC), marker-assisted recurrent selection (MARS) and advanced backcross quantitative trait loci (AB-QTL) analysis, which are routine in breeding programs for major crops, are also being practiced in chickpea. For example, superior lines with enhanced drought tolerance (Varshney et al. 2013b), fusarium wilt and ascochyta blight (Varshney et al. 2014c) have been developed. Introgression of the “*QTL-hotspot*” into several elite varieties in India as well as Kenya and Ethiopia led to development of superior lines with enhanced tolerance to drought and increased yield under rainfed and irrigated conditions irrespective of genetic background (Table 1). Further, the available genomic resources also enabled the successful deployment of modern breeding approaches like genomic selection for faster genetic gains (Roorkiwal et al. 2016).

For effective utilization of the available genomic resources in crop improvement cost effective genotyping platforms also play a major role. Towards this direction, for use in foreground and background selection, cost effective SNP genotyping assays like VeraCode assays (Roorkiwal et al. 2014), KASPar assays (Hiremath et al. 2012) were developed. Recently, a precise and cost effective SNP genotyping platform, with 50,590, high quality non-redundant SNPs on Affymetrix Axiom®*CicerSNP* array has been developed and is being used for high resolution genetic mapping (unpublished data). This array will also be useful for fingerprinting the released varieties as well as assessing their adoption in addition to genetics and breeding applications. In summary, during last 12 years significant progress has been made in terms of developing genomic resources and these resources have been effectively used for attaining faster genetic gains in chickpea.

This article provides a “bird’s eye view” of about 10 years research efforts at ICRISAT using modern technologies towards developing climate resilient chickpeas. To date, besides conserving ~20,000 germplasm accessions, several advanced breeding lines were developed and shared with NARS partners through integrated crop improvements. As a result, in collaboration with different partners across the word, ~350 varieties were released in different parts of the world (Gaur et al. 2014). Further, for making better use of the germplasm lines in chickpea improvement composite collection, reference set and mini-core collections were developed at ICRISAT (see Upadhyaya et al. 2011). Genomic resources developed in recent past enabled trait dissection as well as trait improvement through modern molecular breeding approaches (Varshney, 2016). In addition to ICRISAT, NARS partners also deployed these resources for developing superior lines using MABC approach and several MABC lines have been tested for their yield performance in Advanced Varietal trials during 2016-17 crop season by AICRP on chickpea (Table 2). Ever since the announcement of draft genome, ICRISAT in collaboration with premier research institutes in India developed a road map for deploying the available sequence information for chickpea improvement. In this direction, Department of Agriculture Cooperation & Farmers Welfare, Ministry of Agriculture and Farmers Welfare and Indo-Australian Biotechnology Fund, Ministry of Science and Technology of Government of India facilitated these efforts through funding research projects with major emphasis on identification and delivering genetic improvements in chickpea. In view above, it is essential to continue and expand research efforts in chickpea improvement especially in use of modern approaches in India as well as international level for sustainable chickpea production to meet the demand of ever growing population and to ensure food and nutritional security.

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Table 1: List of elite varieties targeted for molecular breeding to enhance tolerance/resistance to drought, Fusarium wilt and Ascochyta blight by select partners in India and Sub-Saharan Africa

For drought tolerance	For Fusarium wilt resistance	For Ascochyta blight resistance	Institute*
JG 11	C 214	C 214	ICRISAT, India
ICCV 10			
DCP92-3	Pusa 256		IIPR, India
KWR 108			
Pusa 362			IARI, India
	JG 74		JNKVV, Jabalpur
	Phule G12		MPKV, Rahuri
	Annigeri-1		ARS- Kalaburagi
Ejere			EIAR, Ethiopia
Arerti			
ICCV 97105			EU, Kenya
ICCV 95423			

*IIPR = Indian Institute of Pulses Research; JNKVV = Jawaharlal Nehru Krishi Vishwa Vidyalaya; MPKV = Mahatma Phule Krishi Vidyapeeth; ARS = Agricultural Research Station;

EU= Egerton University; EIAR= Ethiopian Institute of Agricultural Research

Table 2: Superior molecular breeding lines in the genetic background of JG 11 and ICCV 10 evaluated in Advanced Varietal Trials of AICRP on chickpea during 2016-17

S No.	Name of the entry	Pedigree	Source†
1.	DIBG 203	[(JG 11 × ICC 4958) × 3*JG 11] - 1	UAS, Dharwad
2.	DIBG 204	[(JG 11 × ICC 4958) × 3*JG 11] - 11	UAS, Dharwad
3.	DIBG 205	[(ICCV 10 × ICC 4958) × 3*ICCV 10] - 21	UAS, Dharwad
4.	NBeG 506	[(JG 11 × ICC 4958) × 3*JG 11] - 35	RARS, Nandyal
5.	NBeG 786	[(JG 11 × ICC 4958) × 3*JG 11] - 40	RARS, Nandyal
6.	NBeG 1004	[(ICCV 10 × ICC 4958) × 3*ICCV 10] - 9	RARS, Nandyal
7.	RKD 1	[(JG 11 × ICC 4958) × 3*JG 11] - 13	ARS-Kalaburagi
8.	RKD 4	[(ICCV 10 × ICC 4958) × 3*ICCV 10] - 2	ARS-Kalaburagi
9.	RVSS 51	[(JG 11 × ICC 4958) × 3*JG 11] - 34	RAKCA, Sehore
10.	RVSSG 52	[(ICCV 10 × ICC 4958) × 3*ICCV 10] - 13	RAKCA, Sehore

†UAS= University of Agricultural Sciences; RARS = Regional Agricultural Research Station; RAKCA = RAK College of Agriculture

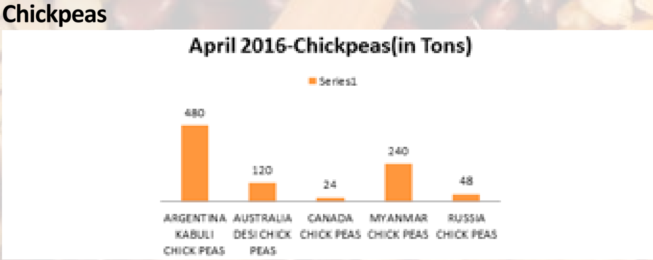
IPGA Research

Overall pulse imports in 2016 were marred by uncertainty due to the fact that an El Nino effect was contemplated in contrast to which there was massive production of pulses globally. Massive production disturbed the pulse imports in back ground of forward contracts with the importers facing challenges of probable loss.

Estimation of a probable El Nino effect and mass production led to confusion in the market scenario. Another issue in this year was the looming threat of plant quarantine measures and resulting penalties. All these reasons put together led to the fall in prices below the MSP. The beginning of the year 2017 set in the looming threat of Indian government insistence on methyl bromide fumigation of imported cargo at the origin. This governmental action has disrupted normal business after the cutoff date of March 31. Canada and USA would be the worst affected as these countries have banned the use of the fumigant on environmental grounds. In the event, overseas prices (especially export prices) are likely to come under downward pressure. Moreover retail businesses in pulse commodity distribution are demanding heavy margins for imported commodities leading to market disruptions. Presented below are the comparisons based on the shipment imported to Mumbai port for the months of April 2016-17 and May 2016-17 for chickpeas, lentils, pigeonpea and black matpe.

April 2016-2017

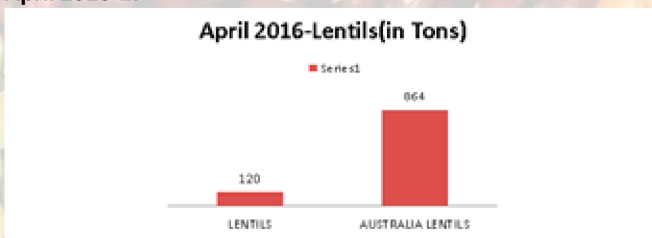
Chickpeas

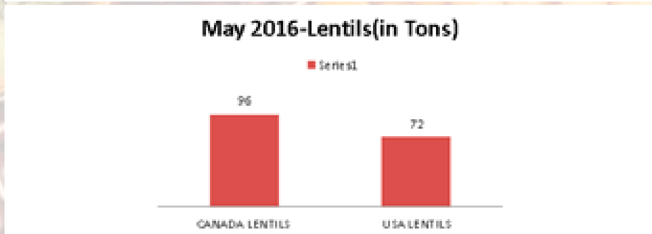


Chickpea imports in April 2017 have risen over April 2017.

Lentils

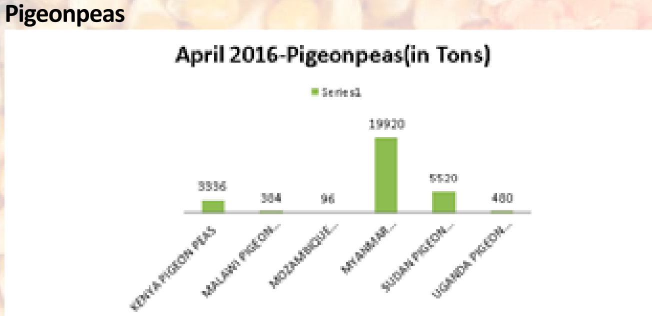
April 2016-17

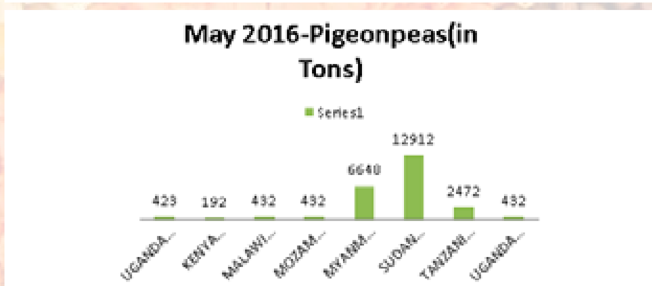




There is a rise in chickpea imports in April 2017 as compared to April 2016.

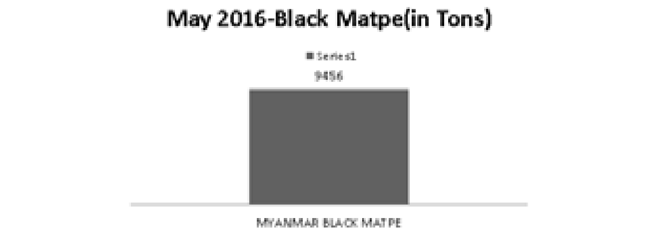
Pigeonpeas





Pigeon imports have declined in April 2017 as compared to imports in April 2016.

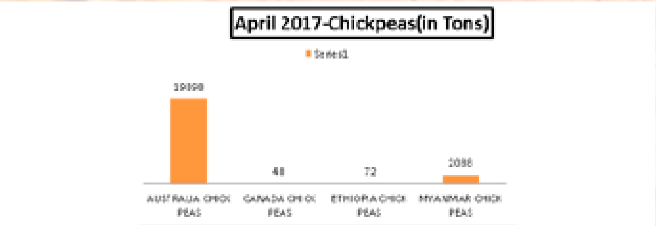
Black Matpe

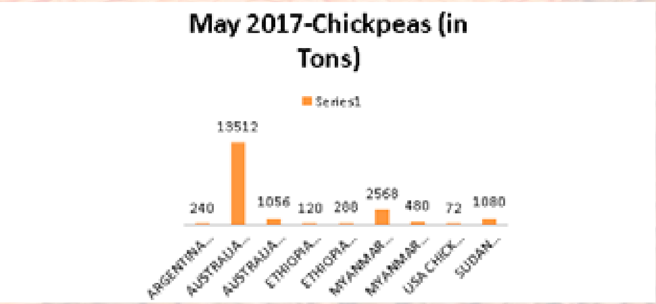


Black matpe import has risen in May 2017 as compared to May 2016 .

May 2016-2017

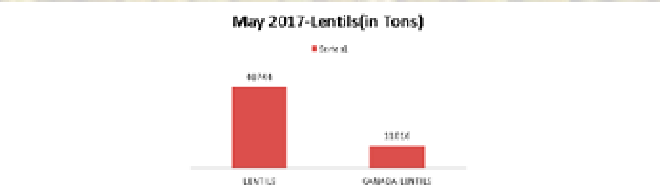
Chickpeas





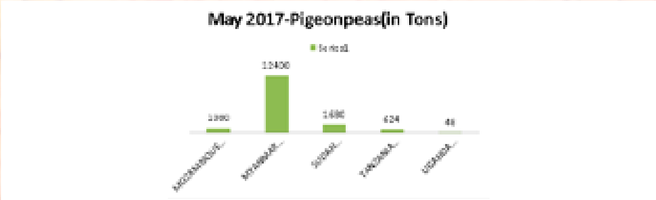
Chickpeas import May 2017 has risen over May 2016.

Lentils



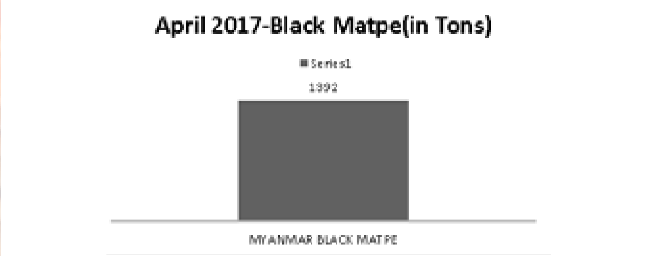
Lentil import in May 2017 are higher as compared to May 2016. Lentils from USA are showing an incline where as that from Canada have reversed the trend.

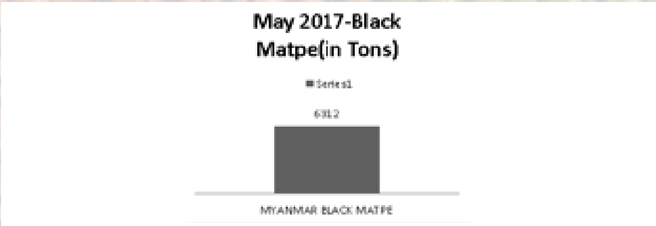
Pigeonpeas



There is a decline in pigeon pea imports in May 2017 as compared to May 2016.

Black Matpe





There has been a decline in imports of Myanmar black matpe in May 2017 in contrast to May 2016.

***Disclaimer-The above data is sourced from variable sources and the comments included are general in nature based on various dependable sources. The same is not to be used for monetary decisions.

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Review Article

EFFECTS OF GAMMA IRRADIATION ON CEREALS AND PULSES- A REVIEW

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ABSTRACT

Many technologies have been studied and executed for the prevention of postharvest losses. Nevertheless, still a huge amount of losses to the extent of 20% still occur in many countries owing to insects and pests alone. According to the United Nations, about 30% of the mortality rate world-wide is caused by alimentary diseases due to some microorganisms, insects or pests through toxin formation in the food products. Gamma irradiation has emerged as an efficient and remarkable technique for the prevention of growth of microorganisms, insects and mites in order to have safe food as well as smooth trading across the borders. Irradiation can contribute to ensure food safety to healthy and compromised consumers (pregnant mothers, immune-compromised patients, people on medication and ageing persons), satisfying quarantine requirements and controlling severe losses during transportation and commercialization. The use of irradiation for decontamination of foods is a promising technology that could be applied to the end product. This technology also has the advantage that it can be applied to fresh, frozen or cooked products to enhance their shelf life. It is a physical, safe, environmentally clean and efficient technology. This paper reviews the application of gamma irradiation for inhibiting the growth of insects, pests and microorganisms.

INTRODUCTION

Food irradiation studies started shortly after World War II. The impetus for this research came largely from intensive investigations of nuclear energy, which led to developments in the economic production of radioactive isotopes and to evolution of high-energy accelerators. In 1963, the U.S. Food and Drug Administration approved irradiation-sterilized bacon, the first in a growing list of proposed products. The safety of irradiated foods has continued to receive attention since then, with several countries gradually adding various products to the list of approved irradiated foods. In 1983 the FDA approved irradiation as a means of controlling microorganisms on spices, and in 1985 the FDA widened the allowed uses of irradiation to additional foods such as strawberries, poultry, ground beef, and pork. In its early development, irradiation was thought of as a process to preserve foods for extended periods by sterilization, much as thermal processing does. However, this has proven to be impractical for many products because the amount of irradiation required to commercially sterilize foods causes its own form of deterioration. Freezing prior to irradiation can reduce the damage, but this makes the process excessively expensive. More recent developments have focused on the use of lower doses of irradiation which are less damaging to the food and have desirable effects. As currently practiced, irradiation is used for three purposes; first, it can be used as an alternative to chemical fumigation to control insects in foods such as cereals, legumes, spices, fruits and vegetables; the second use is to inhibit sprouting or other self-generating mechanisms of deterioration and the third use is to destroy vegetative cells of microorganisms including those that might cause human disease. This results in an increase in safety and shelf life (Becker, 1983; Al-Kaisey *et al*., 2002; Ciesla*et al*., 1991).

Food Irradiation

According to CAC, only three types of radiations are authorized to be used commercially for food irradiation viz X-rays (are the electromagnetic rays with maximum energy not exceeding 5MeV), accelerated electrons (are the beam of electrons produced in Van de Graaff generators, with maximum energy of 10MeV) and radiation from high energy gamma rays (rays produced from radioactive substances like cobolt-60, they have a high penetrating power) (Diehl 2002, Bhat *et al*., 2007). Depending upon the dosage level Irradiation has been classified into three categories viz, *Radappertization* (analogous to radiation sterilization), dosage level 30-40 kGy, used in Canning Industry; *Radurization*, used to enhance shelf life, dosage level is 0.75-2.5kGy, used for fresh meats, poultry, fruits, vegetables and cereals and *Radicidation* (analogous to pasteurization of milk), dosage level is 2.5-10 kGy. Irradiation has also been successfully used for the inhibition and removal of food allergens and anti-nutritional factors such as saponins,

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tannins (Al-Kaisey *et al*., 2002, Byun *et al*., 2002, Diehl 2002, Bhat *et al*., 2007). The other advantages of irradiation treatment pertains to minimal sample preparation, no use of catalyst, high penetration, no increase in temperature during processing (1kGy of radiation increases the temperature of the product only by 0.36°C (Becker, 1983; Farkas, 1998; Diehl, 2002). As far as the safety of the irradiated food is concerned, Becker, (1983), reported that food cannot become radioactive through exposure to gamma rays from Cobolt-60, or accelerated electrons with energy levels below 10 MeV, as the rays are notstrong enough to disintegrate the nucleus of even one atom of a food molecule.

Mechanism of gamma irradiation

Gamma rays destroy the micro-organism by damaging the structure of cell membrane or injuring the critical element in the cell (affects the metabolic enzyme activity or most often is damage to deoxyribonucleic acid (DNA) and ribonucleic acids which are required by microorganism for growth and replication. The effect of radiation become apparent after a period of time, DNA helix fails to unwind and the micro-organism cannot reproduce by replication (Diehl, 1995; Yeh and Yeh, 1993; Ciesla *et al*., 1991). Damage to the genetic material occurs as a result of a direct collision between the radiation energy and the genetic material, or as a result of the radiation ionizing an adjacent molecule, which in turn reacts with the genetic material. In most cells, the adjacent molecule is usually water. In the first instance, the effects are straightforward. An electron randomly strikes the genetic material of the cell and causes a lesion in the DNA. The lesion can be a break in a single strand of the DNA or, if the orientation of the DNA is appropriate, the energy or electron can break both strands on the DNA. However, large numbers of single-strand lesions may exceed the bacterium's repair capability, which ultimately results in the death of the cell. Foods when subjected to irradiation treatment, the rays collide with the food ingredients, causing the breakdown of the chemical bonds and formation of the (short lived) free radicals like hydroxyl, hydrogen atom ($^{\cdot}OH$ and $^{\cdot}H$), hydrogen peroxide and high energy electrons. The free radicals so produced, react with nucleic acids and the chemical bonds that bind one nucleic acid to another, thereby ultimately seizing the growth of microbes and insects (Rayas-Duarte and Rupnow, 1994; Yeh and Yeh, 1993; Ciesla *et al*., 1991).

Factors influencing the effects of irradiation on food

Irradiation Dose

Irradiation dose affects the rate of physicochemical changes that occur in the food product. At lower doses there is a linear relationship between the products formed and the dose. However, at higher doses, there occur secondary reactions between the compounds resulting in the formation of completely new products. I order to achieve the desired effect due to irradiation, the doses need to be optimized. In every application of food irradiation, the basic mechanism involves chemical changes which ultimately decides the amount (dose) of ionizing radiation to be received by the product (Diehl 2002, Bhat *et al*., 2007).

Moisture content

Moisture plays a key role in food irradiation. Water acts as a medium for the free radicals to move and interact with other food components. Free water is thus important in promoting the secondary effects of irradiation. This fact has been proven when food are irradiated in frozen state with the production of limited secondary effects. Secondary effects are also very limited if the moisture content is less than 12% (Hasselman and Marchioni, 1991; Kempner and Haigker, 1982; Rayas-Duarte and Rupnow, 1994).

Temperature

The primary effects of irradiation are independent of the temperature during irradiation. However, the secondary effects are highly temperature dependent. The role of temperature is very critical when irradiation is aimed at sterilization of foods like animal products, protein concentrates etc. Such foods are generally frozen prior to irradiation to minimize the free radical mobility and production of off flavor (Olson, 1998).

Atmosphere during irradiation

Free oxygen in the air behaves like a free radical and combines readily with the reactive compounds in the food matrix (Davis *et al*., 1987; Rayas-Duarte and Rupnow, 1994). In absence of oxygen, irradiation leads to decarboxylation, dehydration and polymerization. The commonly produced radiolytic products include carbon dioxide, carbon monoxide and aldehydes (Giroux and Lacroix, 1998).

Gamma irradiation of Cereals and Pulses

Currently, the legume industry relies on fumigation with methyl bromide (MeBr) for postharvest insect control (Carpenter *et al*., 2000). Since, MeBr leaves residues it possess some harmful health effects which include: abdominal pain, convulsions, dizziness, headache, vomiting, weakness, hallucinations, loss of speech and incoordination. In 2004, India imposed a non-tariff barrier requiring all imported legumes to be fumigated with MeBr and certified free of bruchids. However, most phytosanitary uses of MeBr were phased out in 2005 by the U.S. Environmental Protection Agency (EPA) under the Federal Clean Air Act and the Montreal Protocol. In addition, MeBr fumigation is only practical at treatment temperatures ≥5°C. Therefore, there is a need to develop a practical alternative to MeBr for control of insect pests in both cereals and pulses. At the same time, it is important that alternative must also have a minimum impact on product quality and environment.

Thermal treatment methods using hot air have also been investigated extensively as an alternative to Me Brfor disinfesting stored commodities (Fields, 1992; Dowdy, 1999; Dosland *et al*., 2006). Although heat treatment for the purpose of disinfestation is relatively easy to use, leaves no chemical residues, and may offer some anti-fungi activity, but, unfortunately, it is difficult to accomplish disinfestation using conventional hot air heating methods which may produce certain deleterious effects to product quality (Armstrong, 1994). It has also been observed that using certain appropriate temperature and time combinations required to killing the target insects may reduce the crop nutrients, germination or shelf life of the products (Evans *et al*., 1983). Another common

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difficulty with hot air heating methods is the slow rate of heat transfer due to a high resistance of conduction within bulk materials, resulting in hours of treatment times. On the other hand low heating rates may increase the thermo-tolerance of the targeted insects (Neven, 1998; Thomas and Shellie, 2000; Beckett and Morton, 2003; Yin *et al*., 2006).

Irradiation of cereals and legumes has emerged as a new technology for combatting the problems created by the insects and pests. The main advantage of the gamma irradiation technique is that it can be given after the product has been packed, thereby restricting the chances of cross contamination. The nutritive value, sensory acceptability and other related quality parameters of the cereals and related products can be retained if the doses are optimized and the product is irradiated at the optimized doses. Codex Alimentarius Commission and the World Health Organization (WHO) have adopted the standards for Irradiation of foods, which are practiced by more than 42 countries. Literature studies conducted for the effects of gamma irradiation on different cereals and grains are summarized below and highlighted in Table 1.

approximately 23% protein, 35% starch, 2% fat, and 4% ash (Hamid *et al*., 2016)

The prevention of insect infestation in cowpea seeds has been reported by Diop *et al*., (1997) by using low doses of gamma irradiation. The changes in the nutritive value of proteins and amino acid profiles by gamma irradiation up to 10kGy have been reported to be very small. The functional properties of the gamma irradiated (2, 10, 50 kGy) cowpea flours and pastes were studied by Abu *et al*., (2006) and they found that most of the functional properties related to proteins remained unaffected at low dosage levels, however, at higher dosage levels above 10kGy the functional properties, nitrogen solubility index, swelling and pasting properties significantly changed, which could be attributed to the structural changes in starch brought about by higher irradiation doses.

Buckwheat (*Fagopyrumesculentum),* it belongs to Kingdom: Plantae, Order: Caryophyllales and Family: Polygonaceae

Buckwheat, a short-season crop, grows on low-fertility or acidic soils, with excellent drainage.

Table 1 Effects of gamma irradiation on cereals and pulses: A brief as reported under various studies conducted

Flour	Effects	Reference
Pearl millet	Decrease in leucine, glutamic acid and phenylalanine content	Elshazali *et al*., (2010)
	Decrease in tannin and phytate content	ElShazali *et al*., (2011)
	Increase in water absorption capacity and colour intensity while reduction in viscosity.	Falade and Kolawole (2013)
Tunisian millet	Increase in peroxide value, D_{10} values for total plate count and yeasts and molds was reported as 1.5 and 3.7k Gy respectively.	Mustapha *et al*., (2014)
Legumes	Reduced concentration of anti-nutritional factors, increase in phenolics, antioxidants and total free amino acids content.	Singh *et al*., (2014)
	Increase in water and oil absorption capacity and antioxidant properties.	Jabeen *et al*., (2015)
Sorghum	Decrease in hemicellulose content and increase in digestibility coefficient	Mekkawy, (1996)
	Alpha and beta amylase activity was decreased by 22% and 32% respectively; decrease in microbial load.	Mukisa *et al*., (2011)
Rice	Reduction in ageing time; improvement in processing stability and quality of the products made from the irradiated flours.	Sung, (2005)
	Disinfestation of grains and decreased pasting properties	Zanao *et al*., (2009)
Buckwheat	Increase in peroxide value; decreased viscosity. Oxygen absorbers decreased peroxide value.	Muramatu *et al*., (1991)
Cowpea	Disinfestation, decrease in amino acid content at higher doses	Diop *et al*., (1997)
	Above 10k Gy the functional properties, nitrogen solubility index, swelling and pasting properties decreased.	Abu *et al*., (2006)
Wheat	Increase in water soluble protein and total sugar content and more darker colour with irradiation.	El-Nashaby (1996),
	Combined gamma radiation (1.5 kGy) and infrared radiations for 180 seconds resulted in 96.0% adult mortalities	Mohamed and Mikhaiel (2013)
	Decrease in carotenoid content and reduced viscosity of the starch pastes,increase in the reducing sugar content	Deschreider (1996)
	Reduction in total plate count and cysteine content; increased whiteness in noodles	ManLi *et al*., (2012)

Cowpea (*Vigna unguiculata*), it belongs to Kingdom: Plantae, Order: Fabales and Family: Fabaceae.

Cowpea is one of the most ancient human food sources and has been reported to be used as a crop plant since Neolithic times. Cowpea is now grown throughout the tropics and subtropics and has become a part of the diet of about 110 million people. Its production has spread to East and Central Africa, India, Asia, South and Central America.Cowpea is a rich source of protein for people who cannot afford proteins from animal sources such as meat and fish and are often referred to as poor man's meat. It has been estimated that worldwide area of production of cowpeas is approximately 10.1 million hectares with annual global grain production being approximately 4.99 million tons. In India cowpea is grown on an area of 3.9 million hectares with a production of 2.21 million tonnes with the national productivity of 683 kg per ha. It contains

Too much fertilizers, especially nitrogen, reduces the yield. In hot climates it can only be grown by sowing late during the season, so that the onset of blooming occur during the cold weather. Russia is the major producer of buckwheat followed by China. The major composition of buckwheat consists of 3% fat, 3% ash, 75% starch (25% amylose and 75% amylopectin), 17% protein and approximately 0.1% polyphenols.

Muramatu *et al*., (1989) studied the effects of gamma irradiation (3, 4, 5, 6 and 7 kGy) and electron beam (2 MeV) on the microbial load of buckwheat flour and the products prepared from the irradiated flour. They found that the peroxide value of lipid in buckwheat flour increased with absorbed dose of both gamma-rays and electron beams. However, oxygen absorbers reduced the production of peroxide value. Irradiation also resulted in the decrease of viscosity of dough. The usage of oxygen absorber was found to have resulted in a high sensory score of noodles prepared from irradiated buckwheat flour with minimal changes in color, flavor and texture.

Wheat (*Triticum* sp.), it belongs to Kingdom: Plantae, Order: Poales, Family: Poaceae and Subfamily: Pooideae.

Wheat is an important cereal crop and ranks third in production after maize and rice around the globe. It is the second most important winter cereal in India after rice contributing substantially to the national food security by providing more than 50% of the total calories to the people who mainly depend on it. The annual global wheat production during the year 2014–15 was 717 million metric tonnes and is estimated to reach 720 million metric tonnes during 2015–16, among which India is expected to produce 95 million metric tonnes. It contains approximately 72% carbohydrates, 2% fat, 12% protein and 3% ash (State of Indian Agriculture, 2014-15; Bashir *et al*., 2017; International Grains Council, 2014)

El-Nasha by (1996), studied the effects of different doses of gamma irradiation (2.5, 5 and 10 kGy) on physiochemical, rheological and bread quality of the Egyptian wheat flour. They observed that gamma irradiation does not cause any change in the proximate composition of wheat. However, water soluble proteins and total sugar content increased with storage time for both non-irradiated and irradiated samples. The rheological properties of the dough were found to have modified. Irradiation resulted in darker colour of the crumb while the taste and freshness were retained. A significant enhancement in the loaf weight and volume was obtained with increase in the irradiation dosage.

Amer *et al*., (2007) found that gamma irradiation of the wheat flour up to doses of 7.5 kGy showed improvement in baking and rheological properties but be yond that farino graph, amylo graph and extensor graph properties were found to be changed, which can be attributed to the irradiation induced changes in starch and gluten network.

Mohamed and Mikhaiel (2013) studied the effects of infrared and gamma irradiation (1.5 kGy) on insects in stored wheat grains. They reported that the infrared radiations for 180 seconds (in order to achieve 64.8^{o}C) gave about 60% adult mortality. However, the combined gamma radiation (1.5 kGy) with the equivalent doses of infrared gave 96.0% adult mortalities for the same insects.

Deschreider (1996) studied the effects of gamma irradiation on the carotenoids of the oily fraction of the wheat and reported that the carotenoid content on irradiation gets reduced and further at higher doses (4 Mrad) were undetected. However, they reported that the chemical composition remained unchanged at all doses. They also reported an increase in the reducing sugar content as the irradiation dose was increased. Gamma irradiation was also found to have reduced the viscosity of starch pastes besides increasing the solubility of amylopectin. Areduction in the proteolytic activity of flour was also observed in the case of high doses, which could be attributed not only to the partial denaturation of the proteins but also their polymerization and/or condensation. The polymerization was explained by the reaction of free radicals with the gluten proteins having -SH groups and by the interaction of primary radicals in the protein macromolecules during irradiation. At low gamma radiation doses (0.2 to 1.5 kGy) improvement in the baking properties of the products was observed.

Manupriya *et al*., (2015) studied the changes in total carbohydrate and total antioxidant activity induced by gamma irradiation in wheat flour. They observed that an increase in the antioxidant content of the wheat flour when subjected to the gamma irradiation. Christian *et al*., (2012) reported that falling number of the wheat flour decreased with gamma irradiation (0, 1, 3 and 9 kGy) and took it as a positive effect for bread making process. They also reported an increase in the weight of Pan breads prepared from irradiated wheat flour. Texture analysis displayed a decrease in maximum deformation force for the bread. The disinfestation of the stored wheat grain and flour by gamma rays and microwave heating was studied by El-Naggar and Mikhaiel, (2011), they reported that all the insects were killed within 24 h when gamma irradiation (0.5, 1, 2 and 4 kGy) and microwave were used in the combination for only 30s. They also reported no detectable change in the quality parameters of the wheat grain and wheat flour. However, the germination of the wheat grain was reduced when subjected to microwave but no effect was observed in case of gamma irradiation up to dosage level of 1kGy.

ManLi *et al*., (2012) evaluated the quality parameters of the wheat flour and shelf life of fresh noodles when treated with ozone treatment. Their study revealed that the TPC can be greatly reduced in the wheat flour when treated with ozone. They also found an increased trend in the whiteness of the noodles and flour, dough stability, while the cysteine content was reduced. The noodles showed an increased firmness, springiness and chewiness but the adhesiveness was reduced.

Rice (*Oryza sativa*), it belongs to Kingdom: Plantae, Order:

Poales and Family: Poaceae.

Rice is the most widely consumed staple food by large part of the world's population. It ranks third in terms of production after sugarcane and maize. Rice is an important staple food crop for more than 60% of the world people. Rice is a semiaquatic, annual grass plant and is cultivated in wide range of soil types. It contains approximately 75% carbohydrates, 1% fat, 10% protein and 2% ash.

Sung, (2005) studied the effects of different doses of gamma irradiation (0, 0.01, 0.1, and 1.0 kGy) on the physicochemical properties of the two rice varieties and the products prepared from them. The results revealed that the gamma irradiation reduced the ageing time and improved the processing stability and quality of the products made from the irradiated flours. Zanao *et al*., (2009) studied the effect of gamma irradiation (0.5, 1, 3 and 5 kGy) on physicochemical (grain breakage, longevity composition, apparent amylose content, starch paste properties and colour) and sensory characteristics of raw and cooked rice. They observed that gamma irradiation did not change the percentage of grain breakage during the enrichment process and that irradiation caused a negative effect on the development of insects. The irradiation did not change significantly the percentage composition and the apparent amylase content. Pasting properties decreased with irradiation dose.

Sorghum (*Sorghum*sps), it belongs to Kingdom: Plantae, Order: Poales, Family: Poaceae, and Subfamily: Panicoideae

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Sorghum is widely cultivated in Australia and seventeen of the twenty-five species are native to Australia with the range of some extending to Africa, Asia, and certain islands in the Indian and the Pacific Oceans. Sorghum is mainly composed of about 72% carbohydrates, 3 % fat, 9% protein and 2% ash.

Mekkawy, (1996) irradiated sorghum grains with different doses of gamma irradiation (10, 50, 100, 150 and 200 KGy). He found that gamma irradiation had no effect on total protein, fat and ash contents of sorghum grains. Irradiation treatments of sorghum did not cause a pronounced effect on tannic acid content even the ones which received the highest irradiation dose (200 kGy). Tannic acid is a polyphenol, that has found wide applications in food industry (beer, wine clarification, aroma compound and colour stabilizer in soft drinks and juices). Hemicellulose content was found to have decreased with the increase of irradiation dose levels. Also, it was noticed that feeding rats on basal diets enriched with irradiated sorghum grains had a beneficial effects on digestibility coefficient. Mukisa *et al*., (2011) studied the effects of gamma irradiation (10 and 10+25 kGy) on microbial inactivation, amylase activity and other properties of sorghum flour. They found that the gamma irradiation reduced the activity of amylases (alpha and beta) by 22% and 32% respectively. Irradiation had resulted into more dense porridge products, which they attributed to depolymerisation of starch by gamma irradiation. They also observeda decrease in the microbial load with increase in irradiation doses.

Millets (*Pennisetum* sps), they belong to Kingdom: Plantae, Order: Poales, Family: Poaceae, Subfamily: Panicoideae.

Millets are a group of small-seeded grasses, widely grown around the world for fodder and human food. Millets are important crops in the semiarid tropics of Asia and Africa (especially in India, Mali, Nigeria, and Niger), with 97% of millet production in developing countries. The crop is favoured due to its productivity and short growing season under dry, high-temperature conditions. The most widely grown millet is pearl millet, which is an important crop in India and parts of Africa. Africa is the major producer of millets, followed by India and China. Millets are mainly composed of about 73% carbohydrates, 4 % fat, 11% protein and 3% ash.

Elshazali *et al*., (2010) studied the effects of gamma irradiation (2 kGy) process on total protein and amino acids composition of raw and processed pearl millet flour during storage. They found that except the amino acids leucine, glutamic acid and phenylalanine, most of the other amino acids were stable against all treatments. ElShazali *et al*., (2011) studied protein digestibility, anti-nutrients and sensory quality of pearl millet flour when treated with gamma irradiation (2 kGy). According to the studies conducted by them, gamma irradiation alone has no effect on the tannin and phytate content, but when followed by cooking the amount was found to have significantly reduced. They also reported that the quality attributes of the flour were improved. The color, functional and physiochemical properties of pearl millet at irradiation doses of 2, 4, 6 and 8 kGy was also studied by Falade and Kolawole (2013). In their study they reported that the color intensity was increased by irradiation. Irradiation also resulted in increased water absorption capacity while viscosity was found to have decreased.

The microbiological, antioxidant and physiochemical properties of the Tunisian millet treated with gamma irradiation (1, 2, 3 and 5 kGy) were studied by Mustapha *et al*., (2014), they reported the D_{10} (logarithmic reduction dose) values for total plate count, yeasts and molds as 1.5 and 3.7 kGy respectively. Likewise, gamma irradiation did not alter the fatty acid composition significantly, but the peroxide value increased from the reference value of 26.16 to 34.43 meq O_2/Kg.

Pulses

Pulses are an excellent source of protein, dietary fibre, essential vitamins and minerals. These grains complement proteins from other plant sources, such as, cereal grains, contributing essential amino acids in many parts of world, to the predominantly vegetarian diets. Protein content varries between 15 to 40% depending on the legume, variety and growing conditions. Bioactive components, such as isoflavones and peptides are beneficial for the prevention of cancer and cardiovascular diseases. Legumes mixed with an equal proportion of water, can be used as an egg-replacer in vegan cooking because of its high protein content (Bashir *et al*., 2012; Singh *et al*., 2014; Bashir and Aggarwal, 2016)

Jabeen *et al*., (2015) studied the impact of irradiation (1 kGy) on nutritional quality and functional properties of soy flour and sprouted soy flour. They found that the functional properties (water and oil absorption capacity) of the flour were improved with increased dosage. They also reported that there was an increase inthe antioxidant properties with dosage for both normal and sprouted flour.

Singh *et al*., (2014) studied the effects of gamma irradiation processing (1, 2, 3, 4 and 5 K Gy) on the nutritional quality of legumes (green mung, masur, brown chickpea and kabuli chickpea. They observed that radiation significantly reduces the concentration of anti-nutritional factors in legumes in a dose dependent manner. However, antioxidant and total free amino acid content increased with dosage.

Khattak and Klopfenstein (1989) studied the effects of gamma irradiation (0.5, 1, 2.5 and 5 kGy) on the nutritional quality of grains and legumes with respect to the amino acid profile and available lysine. They reported losses of certain amino acids in the irradiated samples but the available lysine content in the irradiated samples was higher.

Regulatory status on the use of gamma irradiation for cereals and pulses

More than 100 countries have adopted irradiation technology and about 60 different irradiated food products are available in the market, the major ones include potato, onion, meat etc. According to the American Council on Science and Health, in 2003, about 7,000 supermarkets and other retail stores in the US were selling irradiated ground beef. Food irradiation of foods has been approved by the CODEX, Food Safety and Standards Authority of India (FSSAI), Food Standards Australia New Zealand, American Medical Association, the Institute of Food Technologists, International Atomic Energy Agency (IAEA), Food and Agriculture Organisation (FAO), World Health Organisation (WHO). As per the CODEX, the foods having moisture content of less than 12% can be re-irradiated if the objective was not achieved. The CODEX and FAO recommends the use of gamma irradiation for cereals and pulses as maximum of 1 kGy for disinfestation and maximum of 5 kGy for reduction of microbial load.

CONCLUSION

Application of gamma irradiation has shown promising results in extending the shelf life of cereals and pulses by disinfestation and preventing microbial growth. Irradiation has also resulted in increased antioxidant properties besides decreasing the anti-nutritional content of the grains. Food irradiation has been approved by the CODEX, Food Safety and Standards Authority of India (FSSAI), Food Standards Australia New Zealand, American Medical Association, the Institute of Food Technologists, International Atomic Energy Agency (IAEA), Food and Agriculture Organisation (FAO), World Health Organisation (WHO). In spite of the importance of communicating information about food irradiation to consumers, it is also important for regulators and producers to know the consumers general attitude to the technology. This includes trust in regulators and producers and risk perception associated with the use of ionizing radiation in food processing. However, more research is needed to evaluate the mechanism of action of different doses of gamma irradiation on the most important pathogens found in different foods and to optimize the doses. Gamma irradiation seems to be one of the promising techniques of future to be used to meet the ever growing consumer demands for safe food, food security and enhanced food shelf life so as to feed the huge population and to approach the distant markets while maintaining high quality of the food.

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Agricultural Statistics Division
Directorate of Economics & Statistics
Department of Agriculture, Cooperation and Farmers welfare
Third Advance Estimates of Production of Foodgrains for 2016-17

As on 09.05.2017

Million Tonnes

Crop	Season	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16		2016-17	
														3rd Advance Estimates	Final	Targets	3rd Advance Estimates
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19
Rice	Kharif	78.62	72.23	78.27	80.17	82.66	84.91	75.92	80.65	92.78	92.37	91.50	91.39	90.59	91.41	93.00	96.09
	Rabi	9.91	10.90	13.52	13.18	14.03	14.27	13.18	15.33	12.52	12.87	15.15	14.09	12.77	13.00	15.50	13.06
	Total	88.53	83.13	91.79	93.36	96.69	99.18	89.09	95.98	105.30	105.24	106.65	105.48	103.36	104.41	108.50	109.15
Wheat	Rabi	72.16	68.64	69.35	75.81	78.57	80.68	80.80	86.87	94.88	93.51	95.85	86.53	94.04	92.29	96.50	97.44
Jowar	Kharif	4.84	4.04	4.07	3.71	4.11	3.05	2.76	3.44	3.29	2.84	2.39	2.30	1.87	1.82	3.00	1.95
	Rabi	1.84	3.20	3.56	3.44	3.81	4.19	3.93	3.56	2.69	2.44	3.15	3.15	2.72	2.42	3.00	2.80
	Total	6.68	7.24	7.63	7.15	7.93	7.25	6.70	7.00	5.98	5.28	5.54	5.45	4.59	4.24	6.00	4.74
Bajra	Kharif	12.11	7.93	7.68	8.42	9.97	8.89	6.51	10.37	10.28	8.74	9.25	9.18	8.25	8.07	9.50	9.86
Maize	Kharif	12.73	11.48	12.16	11.56	15.11	14.12	12.29	16.64	16.49	16.19	17.14	17.01	15.50	16.05	17.50	19.17
	Rabi	2.25	2.70	2.55	3.54	3.85	5.61	4.43	5.09	5.27	6.06	7.11	7.16	5.53	6.51	7.00	6.97
	Total	14.98	14.17	14.71	15.10	18.96	19.73	16.72	21.73	21.76	22.26	24.26	24.17	21.02	22.57	24.50	26.14
Ragi	Kharif	1.97	2.43	2.35	1.44	2.15	2.04	1.89	2.19	1.93	1.57	1.98	2.06	1.86	1.82	2.00	1.43
Small Millets	Kharif	0.56	0.48	0.47	0.48	0.55	0.44	0.38	0.44	0.45	0.44	0.43	0.39	0.43	0.39	0.50	0.44
Barley	Rabi	1.30	1.21	1.22	1.33	1.20	1.69	1.35	1.66	1.62	1.75	1.83	1.61	1.62	1.44	1.85	1.79
Coarse Cereals	Kharif	32.22	26.36	26.74	25.61	31.89	28.54	23.83	33.08	32.44	29.79	31.20	30.94	27.91	28.15	32.50	32.84
	Rabi	5.39	7.10	7.33	8.31	8.86	11.49	9.72	10.32	9.58	10.25	12.09	11.92	9.87	10.37	11.85	11.55
	Total	37.60	33.46	34.07	33.92	40.75	40.04	33.55	43.40	42.01	40.04	43.29	42.86	37.78	38.52	44.35	44.39
Cereals	Kharif	110.84	98.59	105.01	105.78	114.55	113.45	99.75	113.73	125.22	122.16	122.70	122.34	118.50	119.56	125.50	128.93
	Rabi	87.45	86.64	90.21	97.30	101.46	106.45	103.70	112.52	116.98	116.63	123.09	112.53	116.67	115.66	123.85	122.05
	Total	198.28	185.23	195.22	203.08	216.01	219.90	203.45	226.25	242.20	238.79	245.79	234.87	235.17	235.22	249.35	250.98
Tur	Kharif	2.36	2.35	2.74	2.31	3.08	2.27	2.46	2.86	2.65	3.02	3.17	2.81	2.60	2.56	3.62	4.60
Gram	Rabi	5.72	5.47	5.60	6.33	5.75	7.06	7.48	8.22	7.70	8.83	9.53	7.33	7.48	7.06	9.60	9.08
Urad	Kharif	1.20	0.95	0.90	0.94	1.12	0.84	0.81	1.40	1.23	1.43	1.15	1.28	1.15	1.25	1.45	2.16
	Rabi	0.27	0.38	0.35	0.50	0.34	0.33	0.42	0.36	0.53	0.47	0.55	0.68	0.73	0.70	0.70	0.76
	Total	1.47	1.33	1.25	1.44	1.46	1.17	1.24	1.76	1.77	1.90	1.70	1.96	1.88	1.95	2.15	2.93
Moong	Kharif	1.43	0.81	0.69	0.84	1.25	0.78	0.44	1.53	1.24	0.79	0.96	0.87	1.02	1.00	1.22	1.53
	Rabi	0.28	0.25	0.26	0.28	0.27	0.26	0.25	0.27	0.40	0.40	0.65	0.64	0.56	0.59	0.65	0.54
	Total	1.70	1.06	0.95	1.12	1.52	1.03	0.69	1.80	1.63	1.19	1.61	1.50	1.59	1.59	1.87	2.07
Other Kharif Pulses	Kharif	1.18	0.61	0.54	0.70	0.96	0.80	0.49	1.33	0.93	0.62	0.71	0.77	0.71	0.72	0.96	0.83
Other Rabi Pulses	Rabi	2.48	2.32	2.31	2.29	2.00	2.23	2.31	2.27	2.40	2.73	2.53	2.77	2.80	2.47	2.55	2.90
Total Pulses	Kharif	6.16	4.72	4.86	4.80	6.40	4.69	4.20	7.12	6.06	5.91	5.99	5.73	5.49	5.53	7.25	9.12
	Rabi	8.74	8.41	8.52	9.40	8.36	9.88	10.46	11.12	11.03	12.43	13.25	11.42	11.57	10.82	13.50	13.29
	Total	14.91	13.13	13.38	14.20	14.76	14.57	14.66	18.24	17.09	18.34	19.25	17.15	17.06	16.35	20.75	22.40
Total Foodgrains	Kharif	117.00	103.31	109.87	110.58	120.96	118.14	103.95	120.85	131.27	128.07	128.69	128.06	123.99	125.09	132.75	138.04
	Rabi	96.19	95.05	98.73	106.71	109.82	116.33	114.15	123.64	128.01	129.06	136.35	123.96	128.24	126.47	137.35	135.34
	Total	213.19	198.36	208.60	217.28	230.78	234.47	218.11	244.49	259.29	257.13	265.04	252.02	252.23	251.57	270.10	273.38

Argentina

Germán Sturc
Undersecretary of Agricultural Markets
- Ministry of Agroindustry of Argentina

The Country

Located in the continent of South America, Argentina covers 2,736,690 square kilometers of land and 43,710 square kilometers of water, making it the 8th largest nation in the world, just behind India, with a total area of 2,780,400 square kilometers. Argentina has a population of more than 40 million people and the main area is located around the capital city Buenos Aires, with more than 13 million people living there.

Argentina is a megadiverse country hosting one of the greatest ecosystem varieties in the world: 15 continental zones, 3 oceanic zones, and the Antarctic region are all represented in its territory. This huge ecosystem variety has led to a biological diversity that is among the world's largest. Although the most populated areas are generally temperate, Argentina has an exceptional amount of climate diversity, ranging from subtropical in the north to subpolar in the far south. The average annual precipitation ranges from 150 mm (6 in) in the driest parts of Patagonia to over 2,000 mm (79 in) in the westernmost parts of Patagonia and the northeastern parts of the country. Mean annual temperatures range from -10 °C (14 °F) in the far south to 45 °C (113 °F) in the north.

Economy

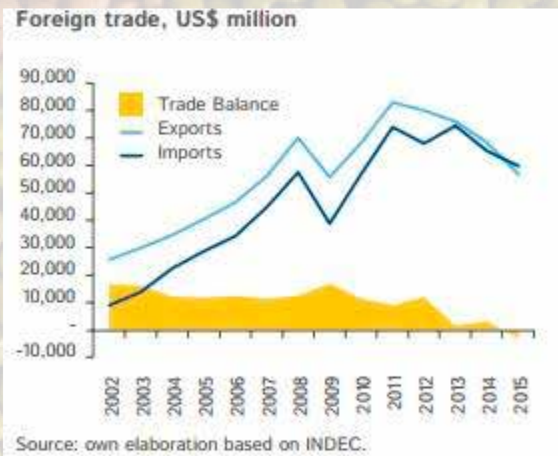
Benefiting from rich natural resources, a highly literate population, a diversified industrial base, and an export-oriented agricultural sector, the economy of Argentina is Latin America's third largest, and the second largest in South America. In 2015, its GDP reached USD 586 billion with GDP per capita at USD 13500 (USD 22,500 in PPP terms). **In the last 10 years, (2005-2015) Argentina´s compound annual growth rate was 3.2%.**

It has a "very high" rating on the Human Development Index and a relatively high GDP per capita, with a considerable internal market size and a growing share of the high-tech sector.

A middle emerging economy and one of the world's top developing nations, Argentina is a member of the G-20 major economies. Historically, however, its economic performance has been very uneven, with high economic growth alternating with severe recessions and income maldistribution.

Foreign Trade

Except for 2015, the trade balance has been positive since 2002. In these 14 years, exports have shown a 212% increase in nominal dollar terms. During the same period, imports have increased by 650%.



Argentina’s main trade partners (imports and exports) are Brazil, China and the United States:

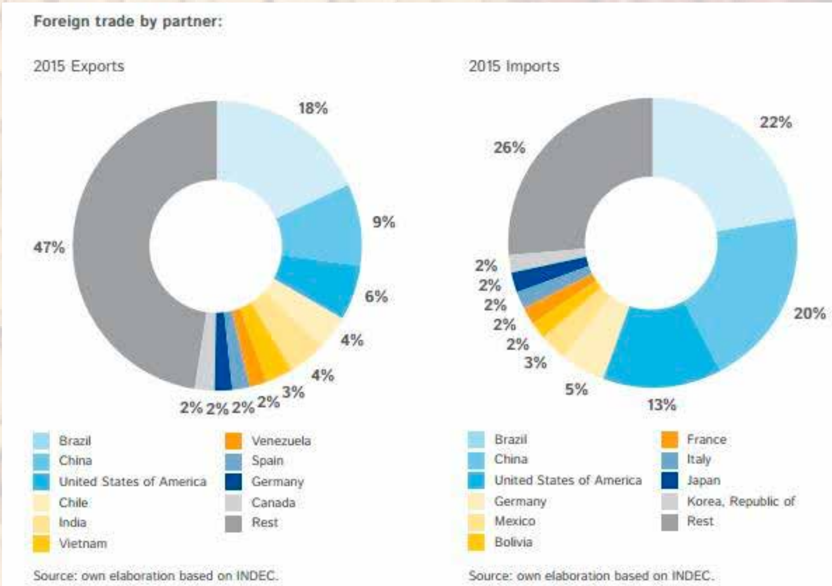
- 71% of exports to Brazil are industrial manufacturing products, of which 60% corresponds to vehicles.
- Over 65% of exports to China are soybean products.
- 11% of exports to the US are biodiesel and crude petroleum oils.

Imports:

• 40% of imports from Brazil are vehicles.

• 34% of imports from China are electrical and electronic equipment.

• 18% of imports form the US are machinery and 16% are mineral fuels, oils and distillation products.



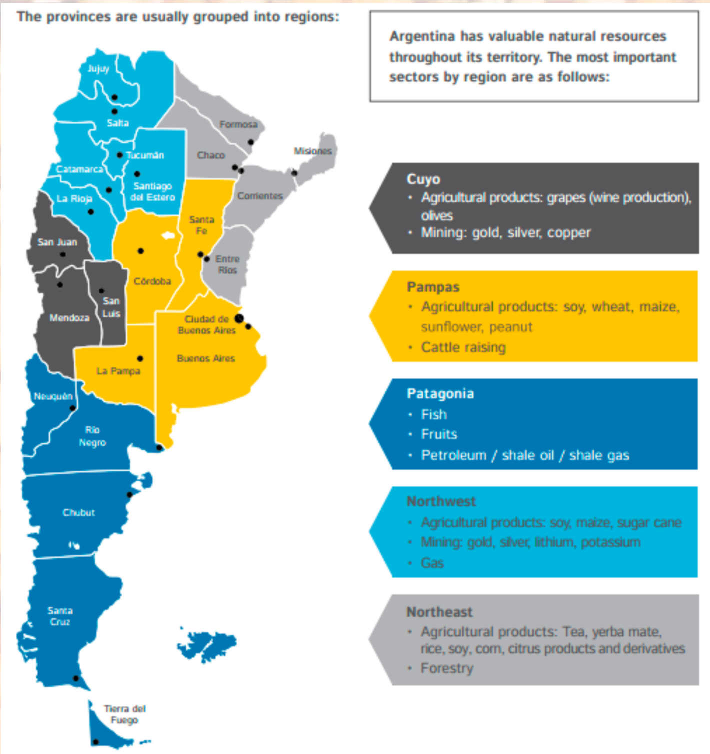
Argentina's Agri-Economy

Argentina is a leading producer of foodstuffs: the third worldwide producer of soybeans, soymeal, soybean oil and corn, the fourth largest producer of sunflower (seed, meal and oil) and sorghum, the seventh largest producer of barley, and the twelfth producer of wheat.

Argentina boasts the world's fourth-biggest shale oil reserves, and the second-biggest shale gas reserves. Other valuable natural resources include gold, copper, lead, zinc, natural borates, bentonite, clays, and construction stone.

Agriculture and agro-industry in Argentina focus on the production of cereal, oil grains and seeds, sugar, fruit, wine, tea, tobacco, and cotton. Argentina is one of the greatest food-producing and food-exporting countries of the world, with an estimated 30 million hectares of arable and permanent cropland.

The principal agricultural region consists of the humid pampas, one of the world's greatest reaches of arable land. Argentine agriculture is virtually coextensive with this region, although efforts have been made to spread it into other areas. Citrus fruit, tobacco, cotton, and sugarcane are cultivated outside the pampas.



Soybean is the leading crop with almost 57 million tons during the last year. Argentina is the third world producer, accounted for about 18% of all soybean produced in the world and was the world's first leading exporter of soy oil and soymeal and third of soybean. Argentina is the fifth-largest corn-growing country in the world, 30 million tons last year and expecting 38 million tons during this harvest, and is the second exporter of the world. Wheat´s harvest last year was almost 11 million tons and the estimation for this year is almost 15 million tons.

Cotton growing dates from 1909 and is concentrated in the northern provinces. In 2016, the production of cotton fiber was 190.000 tons. Sunflower seed oil is a major industrial plant product; 1.7 million hectares of sunflowers were harvested in 2016, producing 3.3 million tons of sunflower seeds.

Fruit growing has developed rapidly since the 1940s. Estimates for 2016 fruit production (in tons) were apples and pears, 0.7 million tons each; oranges, 1 million tons; lemons, 1.5 million tons and nectarines 0.5 million tons. Blackberries and cherries are important products for regional economies with more than 17 thousand tons of annually production of blackberries and 14 thousand tons of cherries.

The province of Mendoza is the center for the nation's vineyards and olive oil. In 2016, grape production in Mendoza was almost 10 million tons (17 million tons in the country, expecting 20 million tons for 2017). Argentina is one of the world's leading producers of wine, exporting 257 million liters in 2016 to every region of the world. Malbec is the varietal insignia of Argentina´s red wines. Olive oil is produced in this area too. Every year the country exports around 20 thousand tons of high quality olive oil.

Indo-Argentinian Trade Relations:

Bilateral trade in goods between Argentina and India registered 6.8% growth in 2016 compared to the previous year. In this way, the volume traded between both countries reached the figure of 2.9 billion May 2017 which grew by 10.47% and surpassed the fall of 3.32% evidenced by the Argentinean purchases to India. Thus, 2016 was the fifth consecutive year of growth of trade between these nations.

As for decades, the balance of trade in goods between the two countries was favorable to Argentina. Also, this surplus for Argentina grew 18.28% in 2016 and reached the record number of 1.5 billion dollars. The three most purchased products by Argentina to India were vehicles for transportation, motorcycles and diesel. While the three products sold by Argentina were soybean oil, sunflower oil and copper minerals.

In relation to the composition of exports of Argentine goods to the Asian country, these were mainly made up of Manufactures of Agricultural Origin (93.74%). In addition, these sales were made up of Primary Products (4.40%), Manufactures of Industrial Origin (1.84%) and Fuels and Energy (0.02%).

With respect to the structure of imports from India, industrial supplies (54.02%), transport equipment, parts and accessories (18.64%) and consumer goods (12.20%) accounted for a large part of the purchases to the eastern country. On the other hand, capital goods (9.94%), fuels and lubricants (4.27%) and food and beverages (0.88%) had a smaller share.
In summary, trade in goods between Argentina and India grew again last year. Although the result of this exchange has been favorable for Argentina for decades, it is evident that the exports were less diversified than the purchases to India and that, in addition, they had less added value.

In a nutshell, both countries have an enormous potential not only in order to grow they own internal markets, but to increase the trade and investment in both ways.

Argentina: The Next Pulses Reservoir

Pradeep Ghorpade
CEO, IPGA

India and Argentina have enormous opportunities to strengthen their trade relations with great possibilities of investment and import of agricultural and food products from Argentina.

Argentina, with a population of 40 million produces agriproducts for 400 million making it one of the most important exporters of agriproducts and food of the world. As a matter of fact, Argentina produces more cereals per-capita in the world than any other country. However, the agri-trade between the two countries has been very limited and one of the main limitations that are presented in the field of investments and trade between the seventh and eighth largest countries in the world is the "ignorance" of the companies from both countries about the qualities and possibilities of the other country.

With this point of view in the horizon, the Ministry of Agroindustry and the Ministry of Foreign Affairs of Argentina are working together to develop this relation. Argentina and India, like complementary economies, can accomplish a win-win relation in the agro industrial trade. It will be fundamental the extension of the India – MERCOSUR Trade Preferential Agreement, in order to expand the commerce and generate synergies of both economies.

In April 2017, Joint Secretary of Agricultural Markets of the Ministry of Agroindustry of the Nation, Jesus Silveyra, with the participation and collaboration of the Joint Secretary of Commercial Promotion and Investment Development of the Ministry of Foreign Affairs and Cult of the Nation Argentine Consulate in Mumbai (CMGUM) invited a delegation from India Pulses and Grains Association (IPGA), India's nodal body for pulses and grains trade to visit Argentina.

The IPGA delegation led by Mr. Pravin Dongre, Chairman of IPGA included Mr. Bimal Kothari, Vice-Chairman, Mr. Sunil Sawla, Joint Treasures of IPGA, Mr. Pradeep Ghorpade, CEO of IPGA and Mr.

Mr. Jesús M. Silveyra, Undersecretary of Agricultural Markets - Ministry of Agroindustry of Argentina; Mr. Pravin Dongre, Chairman – IPGA

From left to right: Mr. Germán Sturc, Ms. Rosario María Martearena, Mr. Zothner Meyer - Deputy Consul General at Consulate General and Promotion Centre of Argentina in Mumbai; Ambassador Gustavo Martino; Mr. Eduardo Soto - Province Director of Agriculture of Buenos Aires; Mr. Jesús M. Silveyra, Undersecretary of Agricultural Markets - Ministry of Agroindustry of Argentina; Mr. Pravin Dongre, Chairman – IPGA; Mr. Bimal Kothari, Vice Chairman – IPGA; Mr. Sunil Sawla, Joint – Treasurer – IPGA; Mr. Pradeep Ghorpade, CEO – IPGA and the team from INTA and SENASA.

Kaushal Shah of Agri Impex. Apart from their respective roles in IPGA, Mr. Dongre, Mr. Kothari and Mr. Sawla are large scale importers and Mr. Kaushal Shah a broker in the pulses sector.

The objective of the visit was for the IPGA delegation to meet senior Ministry officials, Trade Bodies and Producers in the provinces of Buenos Aires, Santa Fe, Cordoba and Salta and to promote cooperation and trade in the pulses sector between both countries.

Argentina currently exports Green Mung Beans, Kabuli Chickpeas and Yellow Peas to India, but not in large quantities. The IPGA delegation also discussed the option of Argentinian producers exploring the option of producing Lentils, Pigeon Peas and Black Matpe which are imported in large quantities by India.

Pulses

Argentina has around 600,000 hectares under pulses cultivation and an average production of 660,000 tons. The main products are Black Beans, Chick Peas, Green Mung Beans and Lentils. Salta and Jujuy provinces contribute over 50% of the pulses production with Buenos Aires, Santa Fe, Tucuman and Cordoba contributing between 10% and 15% each. Almost 97% of their production is exported.

In the year 2016, Argentina exported 654,000 tons of pulses out of which 86,000 tons of Chickpeas, 136,000 tons of Peas and 10,000 tons of Beans were exported to India. They have shown keen interest in producing Pigeon Peas, Black Matpe, and Red Lentils. The Argentinian NPPO, Senasa, has already approved the import of Red Lentil seeds from Canada and they expect to start the production in the near future.

The Senasa team will soon be getting in touch with India's PPQ&S to initiate the process for importing Pigeon Peas and Black Matpe seeds. We have shared the contact details of the PPQ&S team with the Senasa team. The National Institute of Agricultural Technology (INTA), which is a research agency in Salta Province, under Argentina's Ministry of Agroindustry, is also keen to start research on Pigeon Peas and Black Matpe. They will be coordinating with Senasa in Buenos Aires on the same. Once their approvals are in place, then IPGA will be helping them procure seeds to research.

Mr. Pravin Dongre, Chairman – IPGA with Mr. Sergio Busso, Minister of Agriculture and Livestock of Cordoba

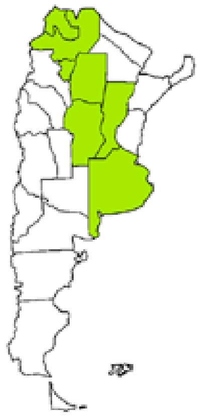
From left to right: Mr. Sergio Busso, Minister of Agriculture and Livestock of Cordoba, Mr. Bimal Kothari, Vice Chairman – IPGA and Mr. Roberto Avalle, Minister of Industry, Trade and Mining of Cordoba

From left to right: The IPGA Delegation with Mr. Sergio Busso, Minister of Agriculture and Livestock of Cordoba; Mr. Roberto Avalle, Minister of Industry, Trade and Mining of Cordoba; Mr. Juan Cruz Molina Hafford, Secretary of Agriculture of Cordoba; Mr. Zothner Meyer - Deputy Consul General at Consulate General and Promotion Centre of Argentina in Mumbai; Ms. Rosario María Martearena, and Mr. Edgardo Delfor Bustamante, Joint Secretary of Agricultural Infrastructure of Cordoba

The IPGA Delegation with Mr. Marcelo López Arias - Secretary of International Relations of Salta, Mr. Nicolás Ramos Mejía - Secretary of Trade, MiPyMe and Local Development, Mr. Javier Montero - Minister of Environment and Sustainable Production of Salta and Mr. Flavio Aguilera - Secretary of Agricultural Affairs of Salta.

The main strengths of pulses production in Argentina are:

- Possibility of production in different areas of the country.
- Lack of natural or climatic barriers to increase the supply of varieties.
- International recognition of Argentine productive quality.
- Argentina is a producer of beans, especially premium quality beans.
- The main opportunities are:
- Unsatisfied and expanding international demand.
- Main source of protein in developing countries.
- Countries with higher purchasing power show a tendency towards greater consumption.
- There are no differentiated tariff barriers in the main markets.



Pulses Production of Argentina		
Year	Hectares	Tons.
2014	431.000	548.500
2015	606.000	743.000
2016*	601.000	662.000

Production per Provinces		
Province	Tons.	%
Salta	233.900	35,3
Jujuy	111.200	16,8
Buenos Aires	87.000	13,1
Córdoba	83.000	12,5
Tucumán	69.000	10,4
Catamarca	36.900	5,5
Santiago del Estero	22.000	3,3
Otras	19.000	3,1
Total	662.000	100

Product	Tons.
Black Beans	176.062
Alubia Beans	167.721
Chickpeas	127.653
Peas	94.278
Red Beans	56.473
Mung Beans	30.322
Adzuki Beans	2.253
Total	**654.761**

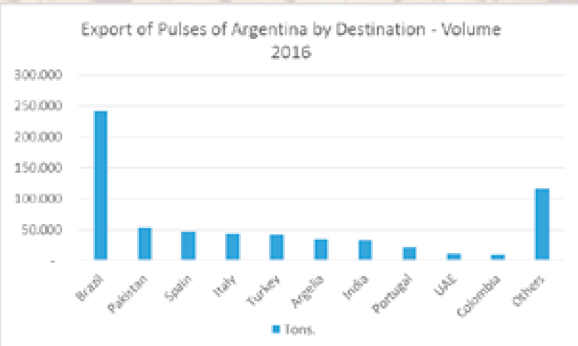
IPGA Delegation Members interacting with producers and trade stakeholders from Salta at the trade interaction organised by The Sociedad Rural Saltena and Prograno

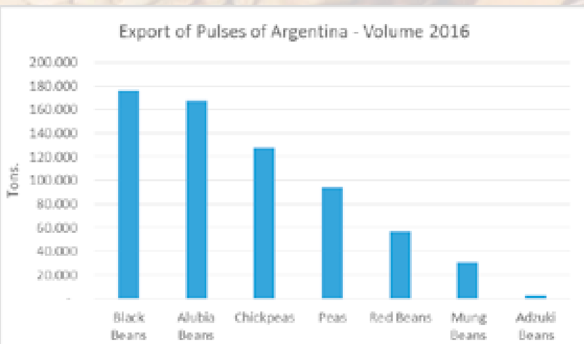
The IPGA Delegation with Mr. Marcelo López Arias, Secretary of International Relations of Salta, and Mr. Javier Montero, Minister of Environment and Sustainable Production of Salta

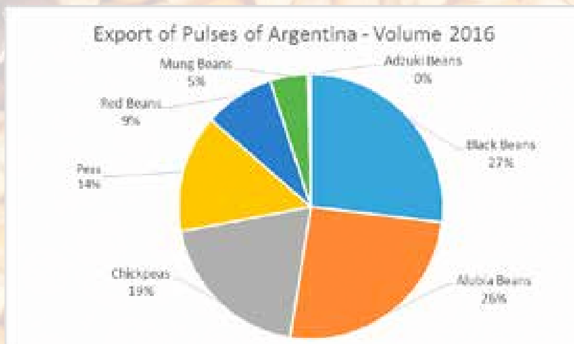
Exports of Pulses

- In 2016, Argentina exported 654 thousand tons of pulses.
- 176.000 tons of Black bean (main destination is Brazil 97%).
- 167.000 tons of Alubia beans to 50 different countries (main destinations are Algeria, Turkey, Italy, Spain, Brazil and other countries in the Middle East).
- 127.000 tons of Chickpea, almost exclusively of the Kabuli variety (main destinations are Pakistan, Italy, Spain, Turkey and India). In 2016 were exported 8,6 thousand tons to India.
- 94.000 tons of Peas, mainly green and some yellow (main destinations are Brazil, India and Spain). In 2016 Argentina exported 13,6 thousand tons to India.
- 89.000 tons of Beans of other colors (mung, cranberry, red, pinto, etc ...) to 65 different countries. In the case of mung, 10 thousand tons to India in 2016.
- 22.000 tons of Lentils (main destination is Brazil).

Source: Ministryof Agroindustry from INDEC data







Mr. Nicolás Ramos Mejía Secretary of Trade, MiPyMe and Local Development with the IPGA Delegation speaking at a trade interaction organised by The Sociedad Rural Saltena and Prograno

CARROT CAKE WITH CHICKPEAS

6 Serves 40min

Ingredients

200 gr. - Chickpeas, boiled | 200 gr. - Carrots, finely grated | 100 gr. - Sugar | 150 gr. - All purpose flour | 100 gr. - Butter, at room temperature | 50 gr. - Coconut, grated | 3 - Eggs | 1 Tsp. - Baking powder | 1/3 Tsp - Ground cinnamon

Preparation

Pre-heat oven at 170ºC. Butter a a 23 cm cake pan and cover the bottom with parchment paper.

Make a pureé with the chickpeas and one egg, set aside.

Sift flour, cinnamon and baking powder, set aside.

Wiisk together sugar and butter until fluffly, add the eggs, one at a time. Incorporate the chickpeas pureé, mix wewll, add the carrots and coconut. Add the flour mixture and beat until incorporated. Fill the pan with the batter, bake for about 30 minutes or until a toohpick inserted in the center comes out clean.

Remove from the oven, let cool . Remove from the pan.

GUACAMOLE TARTLETS

6 Serves | 60min

Ingredients

Tartlets

100 gr. - Chickpeas, cooked | 200 gr. - Strong flour | 1 dl . - Water, lukewarm | 5 gr. - Fresh yeast | 25 dl. - Olive oil, Salt

Guacamole

2 - Avocado, mature | 100 gr. - Chickpeas, cooked | 1 - Garlic clove | 50 gr. - Onion | 1 - Lima, juice, Salt

Preparation

Mix the yeast with 1 dl of water and a teaspoon of sugar, reserve until it is foamy.

Make a purée with the chickpeas and the olive oil. Add the rest of the ingredients, knead for about ten minutes. Make a ball and cover with a cloth or plastic wrap and let it rise in a warm place until it doubles in size.

Pre-heat oven at 180ºC.

On a lightly floured surface roll the dough with a roller pin to 1/2 cm. Cut with a flower shape cookie cutter and place in the holes of a muffin tray. You may brush the inse with egg. bake for about 15 minutes. Remove from the oven.

To prepare the “Guacamole”, purée all the ingrediends. Set aside.

When the tartlets are cold fill them with the guacamole. Serve.

CASTILLIAN CREAM SOUP – CHICKPEAS

4 Serves 40min

Ingredients

1 - Onion, in cubes | 1 - Tomato, pealed and diced | 1 - Carrot, sliced | 2 - Garlic cloves | 3 Tsp. - Olive oil | 300 gr. - Cooked chickpeas | 750 cl. - Broth | 1/4 Tsp - Sweet paprika | 1/4 Tsp - Freshly ground nutmeg | Salt, pepper

Preparation

Heat the olive oil in a saucepan, fry the onion until softened, add the garlic and carrot, continue stirring incorporate the tomato, cook for 5 more minutes stirring al the time, add the spices, chickpeas and broth. Simmer for about 30 minutes. Add more broth if necessary, blend and serve hot.

Pulse Recipe credit www.legumechef.com/en/

Pulse Recipe
MINI AREPA WITH CHICKPEAS AND GO

4 Serves | 25min

Ingredients

200 gr. - Cooked chickpeas | 200 gr. - Cornflour | 1 - Egg
150 gr. - Goat cheese | 4 Tbsp - Olive oil | 150 ml.- Lukewarm water | Salt | Olive oil for frying

Preparation

Purée chickpeas, eggs and goat cheese, set aside.

In a large bowl mix water, corn flour, salt and olive oil. Incorporate the chickpeas purée, mix with the hands to get a smooth dough that doesn’t stick to the hands.

Make small balls of about 30 grams, flattten them with the hands to make round flat cakes.

In a frying pan heat the olive oil at medium heat, until they get golden.

Drain on kitchen paper to eliminate excess oil.

Serve.

National Pulses Seminar 2017, Kolkata

Poonam Vij
IPGA

India Pulses and Grains Association hosted its first ever one-day National Pulses Seminar, at Taj Bengal in Kolkata on March 25th, 2017. The Seminar witnessed participation of over 350 delegates from across the country. Mr. S. Balaji Arunkumar, Dy. Chairman - Kolkata Port Trust and Mr. K. Sashihar, Regional Head-Plant Quarantine Department, Kolkata were the Guests of Honor at the Seminar.

IPGA chose Kolkata as the location for National Pulses Seminar as, after Mumbai, Kolkata is the second largest port to receive imported pulses in India and plays a key role in pulses trade in terms of supplying pulses to East and North Eastern India.

National Pulses Seminar focused on Pulses Demand-Supply scenario, Indian and Global production numbers, expected production numbers for the forthcoming year, policy issues faced by the trade, etc. Industry and Trade experts were invited to deliver presentations on Domestic and International market scenarios. The Seminar began with a Welcome Address by Mr. Pravin Dongre, Chairman - IPGA, during which he announced that the fourth edition of the IPGA biennial event THE PULSES CONCLAVE 2018 will be held on the 14th, 15th & 16th February 2018 at New Delhi.

As a part of the Domestic Crop and Trade outlook of India, Mr. Basant Rathi of GVR Nutries (P) Ltd spoke about the domestic Tur outlook where he presented a SWOT analysis on Tur trade in India. Similarly, Mr. Ajay Jain of AGT Foods spoke on the current Indian market scenario for Lentils. The Chana Crop and Trade outlook was covered by Mr. Sunil Baldewa of BJSN Agro Impex Pvt Ltd where he outlined how over the period of time Chana has had a booming growth in acreage, land under cultivation, production and the pricing across the country. Mr. Rajat Sarda from Rajat Agro Commodities spoke on Kabuli Chana highlighting production numbers and consumption pattern in India.

Mr. Pravin Dongre, Chairman - IPGA

India is the largest producer, consumer and importer of pulses and thus it was essential that the Seminar included Global Crop and Trade outlooks. Mr. Shyam Narsaria covered the Myanmar outlook. As we know Myanmar exports at least 10 varieties of pulses and India is a major market for Myanmar pulses. Along with Myanmar, India is also a major market for pulses trade from African countries. Dr. Bharat Kulkarni discussed the African outlook and Indo-African pulses trade. Mr. Sudhakar Tomar of Hakan Agro summarized the outlook for rest of the world where he discussed challenges in pulses production & research and highlighted recent trends in global pulses sector.

One of the key presentations during the Seminar was regarding GAFTA Regulations which was delivered by Mr. Shailendra Bardia, GAFTA Arbitrator in India. The presentation outlined the GAFTA guidelines for dispute settlements in case of defaults during trade. The Seminar concluded with a Vote of Thanks by Mr. Anurag Tulshan, East –Zone Convener, IPGA.

Please visit www.ipga.co.in to view the presentations delivered at The National Pulses Seminar 2017.

Mr. Bimal Kothari, Vice-Chairman - IPGA

Mr. S Balaji Arunkumar, Dy. Chairman, Kolkata Port Trust

Mr. Anurag Tulshan, East – Zone Convener, IPGA

Mr. K Shashihar, Regional Plant Quarantine Head, Kolkata

Editorial

Yadnya Pitale
COO, IPGA

Chickpea economics has boosted growth in monetary gains for countries like Turkey, Uzbekistan and India itself in terms of foreign exchange. Chick pea as a farm product is not limited to direct consumption but in its journey from farm to table has helped in boosting allied businesses and industries. Value added chickpea food items also add to the chunk of exports and is a rising pulses food processing industry especially in India. The agro processing industry supports allied industries such as packaging and logistics. At the same time, since chickpea is a commodity moving from farm to industry and is expected to perform with a steady growth, it boosts the biofertilizer, farm equipment and warehousing industry at the same time. Hence one can confidently quote that Chickpea as a farm product , is a major contributor to the financial economy. The only deterrent in the chickpea economy are the plant quarantine issues which have given rise to penalties and have nearly become a common feature in absence of fumigation measures not being adhered to.

Chickpeas or garbanzos belong to the universe of legumes , family fabacaea. They are grown extensively in both the hemispheres where drier climates exist and wonderful farm product not affected majorly by climate change .Hence , chicpea based allied industries can be ensured unrestricted supply.

Chickpea farming support to mechanization industry….
Farming which was considered the only hope of income generation is now steadily becoming a less attractive option. Manual harvesting has become an expensive field of operation due to increasing labor cost. Manpower crunch has made farming less attractive and as far as pulses are concerned machine farming is more suited to cutting cereal crops having higher heights. The existing varieties were unsuitable for machine harvesting due to inadequate plant height and also because of branches growing too close to the ground. Indian states of Madhya Pradesh and Maharashtra to promote machine assisted farming have recently introduced two new machine harvestable chickpea varieties ICCV 08102 (RVG 204) and ICCV 08108 (Phule Vikram). The new varieties released have semi-erect growth habit and the first pod height is about 30 cm from the soil surface providing enough ground clearance for machine harvesting. Machine harvesting of chickpea can reduce cost of production, prevent risk of harvest losses, improve resource use efficiency and reduce drudgery for women who carry out the manual harvesting.

Chickpea food processing, a booming industry…..
Chickpea is not only part of the family cuisine but has produced a successful food processing chain due to introduction of wide varieties of fast food recipes. Notable one in the west is the Vegan snack company HIPPEAS which got a celebrity capital boost to help hit the company's goal of tripling revenue this year. Award-winning actor Leonardo DiCaprio and investment firm Strand Equity Partners invested an undisclosed amount for a minority stake in vegan snack company HIPPEAS. The brand has continued to grow with such momentum in the marketplace that it has attracted onboard incredible celebrity board partners. HIPPEAS makes vegan chickpea-based puff snacks in flavors such as Vegan

White Cheddar, Sriracha Sunshine, and Far Out Fajita, which are available at 20,000 stores nationwide, including Starbucks. DiCaprio's investment in chickpea-based products is a smart move, as a new report compiled by research firm Packaged Facts revealed that sales of chickpea snacks increased by 150 percent in 2016.

Brands like Inaaya, Al Fez, The Nibble Box etc have been active players in the Indian chickpea snacks market and are the merits of the flourishing food processing industry in the chickpea sector.

Chickpeas a diet's delight ….

With just one cup serving of chickpeas containing (in daily recommended values) 268 calories, 12.5 grams of dietary fiber, 14.5 grams of protein ,4.2 grams of fat, 84% manganese ,71% folate , 29% copper, 28% phosphorus ,26% iron, 17% zinc. Chickpeas are a gift to health for their properties of lowering blood sugar and assisting weight loss. Chickpeas amongst other pulses are less windy and easy to digest. Like all legumes they form a complex carbohydrate that the body is able to slowly digest and use for purpose of energy. Chickpeas are high in both protein and fiber, which helps one to feel full and curb food cravings and unhealthy snacking. In a healthy diet, about 12 to 20 percent of the total daily calories should come from protein. Human body needs protein for growth, maintenance, and energy. Benefits of protein are that they can store and are used mostly by the muscles with about 60 percent of protein changing into glucose. Moreover, protein intake takes 3 to 4 hours to affect blood sugar levels thus, foods that are mostly protein don't cause much of a rise in blood sugar. Chickpeas nutrition includes starch, which is a slow burning carbohydrate that the body does not react to by suddenly spiking glucose in the blood. Chickpeas have an excellent way of having positive effect on our health which is known for its special fat burning qualities which aid sustainable weight loss. The feeling of satiety upon consuming a chickpea recipe makes one less likely to snack on processed junk foods between meals which can stall ones weight loss. Chickpeas are even more filling if paired with them are other nutritious whole-foods, like vegetables or organic goat cheese. Since, they are so low in calories but high in essential fiber and protein, they are a perfect food for those that need to lose some weight but who are watching calorie intake. Consumption of chickpeas by adding them in salads in their boiled or hummus form makes a diet richer in food value and at the same time cheaper in economic value. In some parts of the world, young chickpea leaves are consumed as cooked green vegetables. Especially in malnourished populations, it can supplement important dietary nutrients, because regions where chickpeas are consumed have been sometimes found to have populations lacking micronutrients. Chickpea leaves have a significantly higher mineral content than cabbage and spinach.

Chickpeas farmer's friends….

Chickpeas are a value addition to the farmer's income . Low water footprint is one of the best qualities of chickpea farming with a 30% higher productivity and price than cereal crops. Moreover, chickpea farming is best suited for dry climatic zones. There have been major scientific advances to develop chickpeas that can flourish in dry climates, to help some of the world's poorest farmers to improve annual yields from current levels of about 1.5 tonnes per hectare to about 5 tonnes per hectare. Low-cost imaging and computing science techniques are being used to speed the breeding of chickpea varieties that give high yields in arid conditions. Algorithms are to be developed to determine how a resilient variety can be bred which will enable breeders to focus on varieties with improved performance. Growing staple food is already a challenge in many poor regions and climate change is adding to the woes.

Chickpeas serve as an energy and protein source as animal feed too. Chickpea are high in proteins and nutrients so much so that the plant body when consumed by farm animals enhances the quality of milk from ruminating animals. Raw chickpeas have a lower trypsin and chymotrypsin inhibitor content than peas, common beans, and soybeans. This leads to higher nutrition values and fewer digestive problems in no ruminants. No ruminant diets can be completed with 200 g/kg of raw chickpeas to promote egg production and growth of birds and pigs. Perennial chickpeas are a fundamental source of nutrition in animal feed as they are high sources of energy and protein for livestock. Unlike other food crops, the perennial chickpea shows a remarkable capacity to change its nutritional content in response to heat cultivation. Treating the chickpea with a constant heat source increases its protein content almost three-fold.

Astrology associates chickpeas with Venus because they were said to offer medical uses such as increasing sperm and milk, helping smooth menstruation cycles and passage of urine in addition to treating kidney stones.

Less challenges and more returns per acre has made this legume crop profitable and its property of being gluten free has replaced many of the carb diets especially on the European and American dining table. Chickpea is a wholesome crop which adds value right from soil to table.

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