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CROP DIVERSIFICATION OPTIONS FOR NUTRITIONAL SECURITY

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Agriculture in India has been a mainstay for growing population over millennia. It has been a major source of employment in India, with 72.4% in 1952 and 52.1% in 2014. Rapid growth of industrial and service sectors outpaced growth of agricultural sector since the 1990s. Nonetheless, there is no alternative to agriculture to feed and fulfil the needs of growing population. The population of India may reach 1.34, 1.39 and 1.81 billion in 2020, 2025 and 2050, representing 17.5%, 17.3% and 19.0% of the world population. Presently, with the rapid growth of population, the pressure on land increased and the size of holdings considerably decreased in spite of extending the cultivation to marginal and sub-marginal lands. Desirable change in the existing system towards more balanced cropping/farming system to meet ever increasing demand of food, feed, fiber, fuel and fertilizer on the one hand and maintenance of agro-ecosystem on the other. It includes the farm diversification through crop substitution and crop intensification. It is the primary approach to crop diversification in production agriculture. Here, diversification takes place through crop intensification by adding new high-value crops to existing cropping systems or to suit the defined objective like use of gap between 2 crops, utilize the space available in fields or bunds, as a way to improve the overall productivity of a farm or region's farming economy. The crop substitution has been important approach to diversification. There are different crop which can be introduced in Rajasthan for increasing the health and nutritional security called super food.Super food are superior source of anti-oxidants and essential nutrient we need. The important super grains are described below-

Quinoa – Quinoa (*Chenopodium quinoa* Wild) is the plant of Amaranthaceae family. Quinoa is cholesterol and gluten free food having low and healthy fat as well as rich source of complete protein. Protein content is very high (14 % by mass) in quinoa as compared to other cereals. It is also rich source of vitamin-B (niacin, riboflavin, thiamine etc.), Vitamin- E and dietary minerals (iron, magnesium, phosphorus, zinc). Lignin (Phyto-nutrient), a valuable nutrient of heart, is abundant in quinoa seeds. Quinoa grains, containing dietary fibre, reduce the risk of high blood pressure and heart attack. There are 9 essential

amino acids which cannot be synthesized by human body are found in quinoa. They are lysine, phenylalanine, threonine, pryptophan, isoleucine, methionine, valine, histidine and leucine. Quinoa is potential source of nutritionally rich oil and fat making, as valuable new oil crop. It contain 5.2 to 9.5 oil, which is similar to corn oil. Three minerals i.e. Calcium, magnesium and iron are mostly deficient in foods and diets which contain gluten (Galvez *et al* 2010). Mant modern food are also deficient in minerals especially magnesium, potassium, zinc and iron. Quinoa grains are rich in minerals like calcium, magnesium, and zinc. It stands out for its high content of these elements as compared to wheat, corn, rice, barley, oats, rye and triticale. Leaves of quinia also rich in minerals, especially calcium, phosphorus and iron.

Chia- chia seeds rank among the top plant based sources of protein. It is drought hardy crop originated in central and southern Mexico and Guatemala. Chia seed are generally used to replace egg content in cakes. It assists digestion of other food. Chia seed contain large amounts of fibre and omega-3 fatty acids, plenty of high quality protein, and several essential minerals and antioxidants. Chia seeds are small, flat and oval-shaped, with ashine and smooth texture. The colour can range from white to brown or black. Chia seeds contain 486 calories per 100 grams, water 6%, carbohydrates 46%, fat 34% and protein 16%. Chia seeds are rich in manganese, phosphorus, copper, selenium, iron, magnesium and calcium nutrients (Ikumi*et al* 2019). Chia seeds contain chlorogenic acid (anti-oxidant), caffeic acid (fight inflammation), quercetin (reduce the risk of heart disease, osteoporosis and certain forms of cancer, and kaempferol(reduce risk of cancer and chronic disease). When chia seeds are placed in water or other liquids, the fibres absorb upto 10 to 12 times their own weight, and the seeds turn into a gel-like mass. In helps to quench the thirst in summer when added in a glass of water. Chia seeds are one of natures richest anti-oxidants which speed up the skin's repair systems and prevent further damage. Taking chia seeds can prevent premature skin aging due to inflammation free radicle damage. It is supper-high in fibre, which is essential for human body's ability to balance insulin levels and can be a natural blood sugar balance. Chia reduces weight. Chia seeds capability to reverse inflammation, regulate cholesterol and lower blood pressure make it extremely beneficial to consume for heart health. Chia seed are high in healthy fats like omega-3 and linilic fatty acid which helps the body to absorb fat soluble vitamins, A, D, E and K.

Finger millet- Finger millet also known as African millet, Ragi, Rajgira, is an important food crop next to rice wheat and maize. It is work as super calcium supplier for growing children, aging people, pregnant ladies. It helps development of bones in children, maintain bone health and prevent erosion in adults. It is also work as an effective food to advert

osteoporosis. Consumption of ragi helps to prevent arthritis, could reduce the risk of fractures and to recover from fractures faster. Ragi is an excellent source of natural Iron. Its consumption help in anemia. Vitamin C increases iron absorption in the body. It is also a low fat cereal in which most of the fat are unsaturated form. This makes it the best choice in grains for people trying to lose weight. The high level of dietary fibre in this cereal aids in proper digestion, normal bowelmovement and prevent and prevents constipation. The insoluble fibres of ragi assists movement of food through the intestines and retain water thereby easing the passage of waste. Thus, it protects our digestive system. Finger millet has been proved to work wonders in bringing own blood cholesterol levels and is one of the best home remedies for heart health. It controls the cholesterol level by reducing plaque formation and preventing blockage of blood vessels thereby cutting down the risk of stroke and other heart diseases. The key amino acids lysine and methionine present in cereals help in lowering cholesterol by extracting and cutting out excess fat from the liver (Chishty and Bissu 2016).

Buck Wheat- Buck-wheat, not like wheat, is refferedto as pseudo-cereal and also known as power-house of nutrient. Buck-wheat is rich in flavonoid, particularly *rutin* that protects against disease by extending the action of vitamin-C and acting as antioxidants. The high level of *rutin* is extracted from the leaves of buck-wheat plants for medicine to treat high blood pressure. Buck-wheat is rich in flavonoid compounds which help in maintain blood flow, keep platelets from clotting excessively. It lowers blood sugars more slowly than rice or wheat products. Buck-wheat is rich in soluble fibre which helps women to avoid gallstones, increase insulin sensitivity, but lowers the secretion of bile acids and blood sugars. Being rich in vitamins-B, particularly niacin, folate and vitamin B6, buckwheat is highly beneficial for cardiovascular health. These vitamin reduce the concentration of cholesterol in the blood. Niacin causes an increase in high density lipoproteins (HDL) which further enhance the blood vessel strength and cholesterol removal. Buckwheat reduce the risk of breast cancer. The plant lignans are converted into mammalians lignans in the intestines. It has an important role to play in skin health so whole buckwheat can be very helpful in weight loss.

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