

Strategic interventions

for enhancing production and productivity of pulses in India

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Pulses are the major source of protein in India, where majority of the population depends on vegetarian diet. Pulses are the integral part of cropping system which provides sustainable path of enhancing soil health through biological nitrogen fixation and reduces the load of chemical fertilizers. It also paves the way for improvement in physical (soil structure and water holding capacity), chemical (organic carbon and nitrogen) and biological (beneficial soil microorganism) properties of soil. Further, root of many pulses release carboxylic acids that solublize phosphate ions from the bound forms such as calcium and iron phosphates that are otherwise unavailable to plants and immobile in the soil.

Key words: Increase production, Productivity, Pulses

PULSES are cultivated around in 24 million ha, mainly in Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh, Karnataka, Andhra Pradesh, Chhattisgarh, Tamil Nadu and Bihar. India is the largest producer, importer and consumer of pulses. The total pulse production during 2017-18 was recorded to 23.95 million tonnes however, it is short by 3-4 million tonnes to meet the present domestic demand.

The pulses requirement in the India is projected to be about 50 million tonnes by 2050 which necessitates an annual growth rate about 4.0%. Hence, looking to the

future demand, it is very essential to improve the production technologies of pulses against the biotic and abiotic constraints.

At global level total area, production and productivity of pulses during 2015 was about 80.8 million ha, 73 million tons and 904 kg/ha, respectively. Chickpea, pigeon pea, mungbean, urdbean, lentil and field pea (dry peas) are the most commonly grown in India and produced in order of 9.08, 4.60, 2.07, 2.93, 0.98 and 0.74 million tonnes, respectively (Table 1). The highest pulse productivity was reported in Jharkhand (1,006 kg/ha) followed by West Bengal, Punjab and Haryana, however, area under pulse is minimum in these states.

Major constraints in pulse production

India has 15 agro-climatic zones with almost all kind of soil types, about 100 cm annual rainfall and have a favourable thermal regime for almost year round cropping. In general pulses are considered as secondary crop among the farmers and they allocate these to poor and marginal land under rainfed and dry

land situations. Identification of region/area specific constraints and application of research and developmental strategies will help in achieving the demand.

Abiotic constraints

Drought: Generally chickpea, red gram, green gram, black gram, cowpea are grown under rainfed conditions, and moisture deficit during the reproductive phases may cause the greater decrease in the yield and pave the way for the terminal drought stress.

Temperature: It plays an important role in the physiological functions of the plant. Too much temperature results in poor pod filling whereas low temperature results in flower drop as well as frost injury.

Waterlogging: Lathyrus and horse gram can grow well in the waterlogged soils, but all other pulses do not tolerate the water logging.

Climatic constraints: Heavy downpour-water logging during the *kharif* and water deficit in winter as well as cold and heat waves reduce the production potential of pulses.

Table 1. Area, production and productivity of total pulses in India

Pulse crop	Area (million ha)	Production (million tonnes)	Productivity (kg/ha)
Pigeonpea	5.39	4.60	854
Chickpea	9.54	9.08	951
Mungbean	4.30	2.07	481
Urdbean	24.0	2.93	651
Lentil	1.28	0.98	765
Fieldpea	0.90	0.74	821

Source: Agricultural statistics at a glance, 2016-17.



Biotic constraints

More than 250 insect-pests and diseases are reported to affect the pulses, of which around one dozen cause severe losses.

Agronomic/cultural constraints:

- Sulphur and zinc are usually deficient in pulse production areas
- Cultivation in marginal lands mostly under rainfed situations
- Lack of suitable cropping systems based approaches for pulse crop production
- Lack of irrigation facilities for the pulse production in marginal lands
- Low genetic potential and productivity of existing varieties
- Lack of mechanization
- Non availability of quality seeds

Socio-economic constraints

- Awareness and access to new technology.
- Lack of quality and improved seeds.
- Non availability of cash and credit facility.
- Farm mechanization.
- Pulse market is fragmented due to the scattered production and consumption across the nation.

Strategies to enhance the productivity and production

Measures to increase pulse production include— adoption of high yielding, biotic and abiotic stress tolerant varieties, adoption of best agronomic management practices, promotion of inter cropping (Table), utilization of rice fallows to increase the area under pulse, substitution of low production cereals and other crops with pulses, mechanization, bringing the waste land areas under pulses and by enhancing irrigation facility through water conservation.

Table 2. Recommended cereal-pulse intercropping system

Cropping system	Row ratio	Location
Mothbean + pearl millet	3:1	Rajasthan
Clusterbean + pearl millet	2:1	Rajasthan
Maize + Black gram	2:2	Rajasthan
Maize + Blackgram	1:1	Uttarkhand
Finger millet + pigeonpea	4:2	Odisha
Sorghum + pigeonpea	1:1	Telangana
Pearl millet + pigeon pea	2:1	Karnataka

Table 3. Recommended oilseed-pulse intercropping system

Cropping system	Row ratio	Location
Groundnut + pigeonpea	2:1	Hyderabad, Telangana
Safflower + chickpea	2:4	Annigeri, Karnataka
Linseed + chickpea	4:1	Delhi
Indian mustard + chickpea	1:2	Meerut, UP
Finger millet + pigeonpea	4:2	Odisha
Indian mustard + chickpea	1:2	New Delhi

Adoption of high yielding, biotic and abiotic stress tolerant varieties

A heat tolerant chickpea line “ICCV 92944” was developed and released as JG 14 in central India for late sown conditions, similarly extra-large seeded (more than 50 g/100 seeds weight), KRIPA (Phule G 0517) for central zone and IPICK 2 for north west plain zone were released during 2009 and 2010 respectively. India achieved milestone in the world’s first cytoplasmic male sterility (CMS) based pigeonpea hybrid GTH1, pigeonpea hybrid 2671, ICPH2740 is under testing in four states, these new varieties along with the availability of quality seeds are yet to reach farmer’s door steps easily.

Adoption of best agronomic management (BAM) practices

1. Pulses require proper tillage practices for the initial establishment of the crop because of their slow early growth
2. Pulses fix atmospheric nitrogen hence reduce the requirement of nitrogen, but require more of phosphorous for proper activation of the root nodules and also calcium (Ca), magnesium (Mg) and Sulphur (S). In pigeonpea + groundnut intercropping system (Table 3) an application of 35 kg S by gypsum resulted in higher net income and B:C ratio.
3. The primary constrain in maintaining or increasing pulse production in the semi-arid regions is shortage of water. The good agricultural practices involving appropriate water conservation and its management are—precision irrigation management amalgamated with the land leveling, no till systems, FIRB planting systems, crop diversification and residue management etc. These have

shown tremendous potential for higher water productivity and its use efficiency.

4. Weeds are a serious problems in pulses because of short statured plants like lentil, chickpea and also slow initial growth of crops like pigeon pea. Stale seedbed practice are effective for weed management; pre emergence herbicides provide effective control of weeds up to about one month of crop growth. Herbicides like imazethapyr and quizaloprophyl can be used in specific crops for controlling post emergence weeds.
5. One of the options is to increase acreage of pulses by the way of intercropping. No till machinery developed for rice –wheat systems need to be evaluated for planting pulse as a relay crop in the irrigated crops such as rice. Furthermore, production costs need to be reduced so that cropping becomes more remunerative since most of the pulses growers by small and marginal farmers.

The National Agricultural Research System (NARS) has also developed several pulse crop specific best management practices which are being promoted through the department of Agriculture and Cooperation, practices which have found with the favor to farmers and need to promoted are:

- Systems for surveillance and monitoring of pests in pigeonpea for timely preventive measures should be taken
- Transplanting and dibbling techniques to achieve optimum plant population and better productivity of pigeonpea. This is being extensively used as contingency plan to deal with drought situation and delayed monsoon scenario in Maharashtra



and Karnataka. In this method the pigeon pea seedlings were raised in nursery (polybag or nursery tray), seedlings will be ready in about 30-40 days and then transplanted in to the main field. It yields about 12-14 q/acre in rainfed conditions and about 16-18 q/acre in irrigated conditions.

- Site specific nutrient management including application of 20-25 kg sulphur and 15-20 kg ZnSO₄/ha. Gypsum is one of the low priced sources of sulphur and calcium and also improves physical properties of soil.
- Foliar spray of 2% urea at pod-formation stage to off-set drought effect in case subdued monsoon.
- Seed priming (soaking seed in water) before sowing for better germination in rice fallows/rain fed situation.
- Seed inoculation with rhizobium and PSB e.g. *Pseudomonas putida* (Sp21 and Sp22) promote growth through an improvement in the nodulation and biological nitrogen fixing activity. The rhizobia strains assayed are capable of coexisting with *Pseudomonas*, with meaningful differences being observed in percentage of nodulation and air portion in co-inoculated legumes,

hence, it enhances productivity.

- Raised bed planting to economize water and also to off-set waterlogging stress during excess rainfall period. It is reported to improve yield by 10-20%, raised-sunken systems of planting needs to be promoted in rain fed areas of the country.
- Large-scale promotion of drip and sprinkler irrigation for higher water use efficiency in rain fed areas. Stored rainwater during monsoon can be effectively used for life saving irrigation.

Future research and development strategies

The pulse crop research is to be increased to find the technological intervention to the problem of low productivity. Some of the high priority research areas include development of:

- cytoplasmic male sterility based hybrids in the pigeonpea and early maturing with uniform maturity green gram varieties
- transgenic in pigeonpea and chickpea for resistance to *Helicoverpa* and other diseases
- short duration, short stature and water logging-tolerant, high-yielding pigeonpea varieties for

Punjab and Haryana

- large-seeded varieties of Kabuli chickpea
- low neuro-toxin and high-yielding lathyrus varieties
- varieties with repellent character to off-set grazing by wild animals like blue bulls
- machineries to enable good intercropping combinations and geometries, and
- rain water harvesting and storage strategy in rainfed areas during *kharif* for life-saving irrigation in *rabi* pulses.

SUMMARY

Pulses are an important and integral part of Indian diet, and it is necessary to increase the acreage of pulses by way of intercropping. Crop diversification towards legumes, development of the varieties to increase production and productivity, rice-fallow and conservation tillage, improved crop specific practices, water harvesting and supplemental irrigation, use of bio-fertilizers, balanced nutrient management will improve the pulses production of our country.

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- Increase our intake of fruits, vegetables, legumes, nuts and whole grains.
- Limit the consumption of foods that require an excessive use of natural resources, such as water, to be produced.
- Consume fewer foods and drinks which are high in refined sugars, saturated fats and/or salt.
- Consider the environmental impact of the foods we eat.
- Reduce or eliminate consumption of industrialized and convenience foods to favour more diverse and traditional foods, in an effort to support local biodiversity.
- Learn or revisit lessons about local, seasonal foods, their nutritional values and how to cook and preserve them.

Courtesy: www.fao.org/world-food-day

