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Pulses production in India: Issues and elucidations

Rajeev Singh, Maneesh Kumar Singh, Amit Kumar Singh and Chandan Singh

Abstract
Most of the people in India is at a standstill vegetarian in dietary habit and depends upon vegetative source to meet out its daily nutritional requirement. Pulses are grown across the country with the highest share coming from Madhya Pradesh (24.00%), Uttar Pradesh (16.00%), Maharashtra (14.00%), Andhra Pradesh (10.00%), Karnataka (7.00%) and Rajasthan (6.00%), which together share about 77.00% of the total pulse production, while the remaining 23.00% is contributed by Gujarat, Chhattisgarh, Bihar, Orissa and Jharkhand. There are several issues related to pulse production like inauspicious weather condition, anomalous soil, several agronomic limitations, pests and diseases, blue bull problem and policy constraints, credit and marketing of pulses, which were discussed here. There is need to adopt all the components of supporter technology as a unit which help to overcome several complications in soil health hazards and poor response of technology in high production of pulses in India.

Keywords: Gram, pea pegionpea, nutritive value of pulses and diseases and insets pests of major pulses

Introduction
Pulses play a vital role in our lives. The word “Pulse” is derived from the Latin word “Puls” meaning pottage i.e. seeds boiled to make porridge or thick soup. Pulses are the cheapest source of dietary proteins. The high content of protein in pulses makes the diet more nutritive for vegetarian when taken with other cooked food items. Pulses contain the same amount of calories as cereals but the protein content varies. The protein content of pulses are twice that of cereals (20-25%) and almost equal to that of meat and poultry. But the quality of protein content is inferior to animal protein. They provide the same amount of calories as cereals, which are staple food all over the world. If we take 100g of dry pulses, it would contain about 350 Kcal of energy. Pulses are good sources of proteins and commonly called the poor man’s meat (Reddy, 2009) [8, 9].

At the world level pulses are grown in an area of 78 million hectares with an annual production of 70 million tonnes (MT) and productivity of 908 kg/hectare (FAO& Agricultural org. 2012). In India pulses are grown on 22.23 million hectares of area with an annual production of 13.15 million tonnes (MT).India accounts for 33% of the world's area under pulses and 22% of the world production of pulses. About 90.00% of the global pigeonpea, 65.00% of chickpea and 37.00% of lentil area falls in India, corresponding to 93.00, 68.00 and 32.00 percent; of the global production, respectively (FAO Stat 2011).

Table 1: Nutritive value of Pulses

Constituents	Magnitudes	Constituents	Magnitudes
Protein	>20-%	Iron	7-10mg/100 g
Carbohydrate	55 – 60%	Vitamin C	10-15 mg/100 g
Fat	>1.0%	Calcium	69 -75mg/100g
Fibre	3.2%	Calorific value	343
Phosphorus	300-500 mg/100 g	Vitamin A	430-489 IU

Source; Singh *et al.* 2015

Pulses are grown globally covering large dimension of about 70.50 million hectares in area with a total production of 57.27 million tonnes. Among different pulse producing countries, India ranks first having 29.96% of the total pulse acreage (2003-2004) though it contributes only 22.52% of the global pulse production. Over a dozen pulse crops are grown in the country and among these, Chickpea(Chana), Pigeon pea (Arhar), Mungbean (Moong) and Urdbean (Urd) are the most important, contributing total 86.00% (45.00% of chickpea, 20.00% of pigeon pea, 10.00% of mungbean and 11.00% of urdbean) of the total pulses production (http://www.iipr.res.in/pe/introduction.asp). India is the world's largest producer and the largest consumer of pulses. Pakistan, Canada, Burma, Australia and the United States, in that order, are significant exporters and are India's most significant suppliers. In spite of this, the net per capita availability of pulses has come down over years from 61.00 grams per day per person in 1951 to 32 grams per day per person in 2010. Thus the availability of pulse per capita per day has proportionately declined from 71.00 g (1955) to 36.90 g (1998) against the minimum requirement of 70.00 g per capita per day. There is not much possibility of the import of pulses in the country. The production of pulses has to be increased internally to meet the demand (Singh, 2012) [14].

The trend in cross-border trade across the world is a major factor that influences pulses prices. Global trade in pulses increased almost six fold over the past three decades, from 1.70 million tonnes in 1981 to 12.40 million tonnes in 2011. With the value of global exports increasing morethan 11 times over the same period, the unit value of exports increased almost four times from \$133.8 in 1961 to \$654.6 in 2011, representing an annual average increase of 7.60%. On the other hand, the total production globally increased by just around 69.00% over the same half a century, from 40.35 million tonnes to 68.20 million tonnes.

Pulses are grown across the country with the highest share coming from Madhya Pradesh (24.00%), Uttar Pradesh (16.00%), Maharashtra (14.00%), Andhra Pradesh (10.00%), Karnataka (7.00%) and Rajasthan (6.00%), which together share about 77.00% of the total pulse production, while the remaining 23.00% is contributed by Gujarat, Chhattisgarh, Bihar, Orissa and Jharkhand. Indian Institute of Pulses Research (IIPR) in its vision 2030 projected pulses demand to be 32.00 MT by the year 2030. The projected domestic production from this study is 20.00 MT by 2020. As per Mittal, the required growth in domestic production (supply) of pulses is 6.51% per annum, while IIPR (2011) estimated the required growth rate in production to be 4.20% per annum to meet the growing demand. All these estimates indicate that, to bridge the gap between demand and supply, pulses production should grow at least 4-6% per annum. However, the current growth rate is only 3.35% per annum (http://www.iipr.res.in/pe/introduction.asp).

Area, production and productivity of pulses in India were 23.47 million hactare, 18.34 million tonnes, and 781 kg/ha respectively (National Council of Applied Economic Research New Delhi 2012-13). While area, production, and productivity in Uttar Pradesh were 2.31 million hectare, 1.71 million tones and 742.00 kg/hectare respectively (Directorate of Economics and Statistics, Department of Agriculture and cooperation 2013-14). In view of the above, a review on issues related to pulse production and its elucidations is presented here.

Inauspicious weather for pulses

Poor soil and agro-climatic conditions not only force late sowing of legumes however leads to reduced length of growing period but also necessitate to sustain cold injuries at early vegetative phase which freeze all biological activities for prolonged period. A sudden rises in temperature after that, not only induces forced maturity but simultaneously invites several biotic stress viz., diseases and insects pests (Ali *et al.*, 2012; Reddy, 2009 and Singh and Singh, 2008) [1, 8, 9, 12]. Traditionally r*abi*pulses sowing were delayed up to last week of November and some time under extreme circumstances it goes up to the first fortnight of December. However, optimum sowing time of lentil is first fortnight of October (Ramakrishna *et al.*, 2000) [6]. Few winter legumes including lentil are also grown as a paira crop in the eastern India, which helps in timely planting of the crop even before, the paddy has been harvested (Singh and Singh, 1995) [9].

Anomalous soil conditions

In general, pulses crop prefer neutral soil reactions and are very sensitive to acidic, saline and alkaline soil. Indian soils especially, north -western soils having high pH contrary to eastern and north eastern part which are characterized as acidic soils. Due these soil conditions deficiency of micronutrient is pronounce up to acute shortage level. Acute deficiency with respect to zinc, iron, boron and molybdenum and that of secondary nutrients like sulphur particularly in traditional pulse growing (Singh *et al.*, 2013d) [15].

Agronomic limitations

Improper sowing time, low seed rate, defective sowing method, insufficient irrigation, inadequate intercultural, sowing under *utera* without proper management are major agronomic limitations (Ramakrishna *et al.*, 2000 and Reddy, 2009) [6, 8, 9]. Consequent upon delayed planting, early encounter with severe cold, growth and development of lentil crop gets hampered for a considerable period. Subsequently plants get comparatively less time to complete their lifecycle which, by and large forces maturity (Ramakrishna *et al.*, 2000) [6]. For posture, in Eastern India, normal sown lentil is a medium duration (130-150 days) crop, while under late sown conditions it is forced to complete its life cycle in 105±5 days (Joshi, 1998; Ramakrishna *et al.*, 2000; Reddy, 2009; Singh and Singh, 2008 and Singh *et al.*, 2012a) [5, 6, 8, 9, 12, 14].

Typically, late sown rabi pulses lentil and chick pea undergoes three distinct phases and considerable degrees of phenological modifications are bound to happen. Eventually, lentil crop during its early seedling phase grows slowly due to its energy invested in the initial establishment (Singh *et al.*, 2002) [20]. However, in mid-phase, very insignificant growth and development is observed. This poses serious threat to realization of yield potential due to cold injuries. This phase is very important for creating source of channelizing the energy at later stage. In the last and most important phase lentil faces heat injury, resulting in early onset of reproductive phase, causing imbalance in resources and inputs, biotic stress and forced maturity (Joshi, 1998; Dixit *et al.* 2009; Reid *et al.*, 2011 and Singh and Bhatt, 2013) [5, 4, 10, 11]. An earlier study revealed that area under pulses in mostly predetermined, but as the irrigated area increases, pulses are relocated to rainfed areas and their area is replaced by cereals or some cash crop (Singh *et al.*, 1995) [19]. In India, the irrigated area under pulses was only 12 per cent, while under wheat and paddy; it was more than 60 per cent of the total area (Reddy and Reddy, 2010) [7].

Pests and diseases

Although legumes crops are prone to many insect pests and seed borne diseases, a major cause of concern as its incidence, if not controlled, demolishing the crop. *Fusarium* wilt is wide spread in legumes growing regions. In addition, heavy damage to legumes grain is caused by pests during storage. Legumes are in general pest free crop under normal condition if proper crop rotation is follows. However Pod borer, Aphids and Wilt *(Fusariumlentis)* are major insects and disease pests (Singh *et al.*, 2013b and Singh *et al.*, 2013g) [13, 18]. Hence the control measures of all three are listed in Table 2.

Table 2: Important diseases and insets pests of major pulses

Crop	Disease	Insect pests
Chickpea	*Fusarium* wilt, *Ascoochyta* blight, *Botrytis* grey mould and stunt virus	Pod borer and cut worm
Pigeon pea	Sterility mosaic virus, *Fusarium* wilt, *Phytophthora* stem blight *Alternaria* leaf spot and powdery mildew	Pod borer and pod fly leaf tier
Urd and Mung	Yellow mosaic virus, *Cercosora* leaf spot, powdery mildew, leaf crinple virus and root rot	white fly, Jassid and pod borer
Lentil	Rust, wilt Sclerotinia blight, collor rot	Pod borer
Field pea	Powdery mildew, rust, downy mildew, wilt	Pod borer, stem borer, leaf minor

Blue Bull to pulses
Legume crops are vulnerable to attack by Blue Bulls in the Indo-Gangetic Plains. Because of the widespread danger particularly in Uttar Pradesh, Bihar, Madhya Pradesh, Rajasthan and Chhattisgarh the potential area suitable for taking legumes crops is left uncultivated by the farmers. Till date it is observed that there is no viable strategy available in the country to effectively control this menace.

Policy constraints, Credit and Marketing of pulses
Mostly small and marginal farmers are engaged in cultivation of legumes. A majority are in areas with poor banking infrastructure. They have poor resource base and lack risk-bearing capacity. They are therefore either lack access to credit or turn debtors. Delivery of credit to such farmers is also not hastle-free. There is lack of marketing network in remote areas. Procurement of produce by a dedicated agency is virtually non-existent or in-effective. System of regulating quality of inputs though in place in all the states, needs to be made more effective. Delivery of improved technology, inputs, credits need to be stream lined through appropriate policy interventions. Benefit of crop insurance need to be extended to pulses farmers Singh *et al*., 2013a) [17].

Endorsement of pulses cultivation
There are number of promising intercropping systems for pulses developed by Agricultural Research Stations. Farmers in rainfed states (Gujarat, Madhya Pradesh, Chhattisgarh, Maharashtra, Karnataka, and Andhra Pradesh) are familiar, some of them as they have been practicing them in traditional ways. The approach to be followed by the rainfed states should include: a) Identification of districts and promising intercropping systems for each agro-climatic zone and setting of area coverage targets. b) Conduction of field demonstrations on intercropping with farmer's active participation and comparing returns with sole cropping system. c) Ensuring availability of seed of pulse varieties recommended for intercropping. d) Demonstration of suitable seeding devices (animal drawn and tractor drawn) for simultaneously planting of main and intercrop components. e) Seed-minikits of pulses may be given to farmers opting for intercropping only. f) KVKs at districts level should be involved in training of farmers and field demonstration of production technology (Singh *et al*., 2013).

Table 3: Intercropping of different pulse producing States

Intercropping systems	States
Soybean + Pigeon pea	Madhya Pradesh, Maharashtra
Pearl millet/sorghum + Pigeon pea	Karnataka, Andhra Pradesh, Gujarat, Maharashtra
Groundnut + Pigeon pea	Gujarat
Groundnut/ Sorghum/Pearl Millet + Urdbean	Bihar, Maharashtra, Madhya Pradesh, Karnataka,
Mungbean/ Cowpea	Gujarat, Uttar Pradesh, Rajasthan
Sugarcane + Cowpea/Mungbean / Urdbean	Uttar Pradesh, Maharashtra, Karnataka AndhraPradesh, Tamil Nadu
Cotton + Mungbean / Urdbean /Cowpea	Punjab, Haryana, Madhya Pradesh, Gujarat, Andhra Pradesh, Maharashtra

Post-harvest management
Mechanical threshing needs to be promoted for post-harvest management of pulses by providing incentives for purchase of threshers. Procurement of pulses grains by Govt. authorized organizations will considerably reduce the need for storage at farmer level. Small Dal-mills should be popularized and promoted. Private sectors also encourage establishing 'Dal Mill's in rural areas/districts with large acreage under pulses on the pattern of sugar mills. Private companies should be concerned in processing, packing and marketing of pulses. The public sector procurement agencies are harshly handicapped for funds and expertise in this area Singh *et al*., 2013a) [17].

Expansion of irrigation
Pulses crops are perpetually grown under moisture stress conditions which lead to sub-optimal productivity levels. Scientific scheduling of irrigation, an estimate of quantity of water to be applied and deployment of water saving irrigation methods not only enhanced yield but also higher water and nutrient use efficiency and larger area coverage under irrigation. Use of sprinkler irrigation has enormous potential for saving irrigation water and expanding area under irrigation. The method has gained popularity in many districts with limited water resources. Drip irrigation attention of the policy makers, administrators, social workers, as it has assumed social, economic and ecological dimensions. Fertigation hold promise for widely spaced crops like pigeonpea. These devices can expand irrigation area by 30-50% Singh *et al*., 2013a) [17].

Conclusion
A holistic approach is required to enhance the production and productivity of pulses crop rather than a single approach method. Best agronomic practices (BAP) and their different components has potential to stand out under change climate condition, there is need to adopt all the components of supporter technology as a unit not to choose few of them, which help to overcome several complication in soil health hazards and poor response of technology. These steps may be taken on priority basis for improving pulse productivity some of them are (1) Encouraging accelerated adoption of present technology for viaduct the yield gap (2) Institutional support to improve seed replacement rate and quality production. (3)

reinforcement of life-saving irrigation in pulse growing pockets (4) assuring availability of critical inputs viz., seed fertilizer, pesticides (5) Gradual automation for pulse production (6) Public–Private partnership for sustaining chain and to diminishing post-harvest losses (7) Policy support for worth chain of pulses.

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