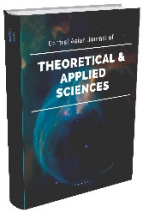

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Effect of Bio-Dynamic Manure on Growth Yield and Quality of Pigeon Pea Under Climatic Condition of Bindh Region

Dr. PK Singh
Senior Scientist and Head, A.N.D, University of Agriculture & Technology, Ayodhya (U.P.)

Dr. Rashmi Singh
SMS (Home Science), A.N.D, University of Agriculture & Technology, Ayodhya (U.P.)

KVK Sonbhadra
A.N.D, University of Agriculture & Technology, Ayodhya (U.P.)

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Annotation: *Biodynamic agriculture was born when Dr Rudolf Steiner gave eight lectures about a new method of agriculture to a large group of farmers in Germany, in 1924. Rudolf Steiner was an Austrian philosopher and scientist who's thought was very much influenced by oriental philosophy, especially Buddhism, Hinduism, and the Vedic scriptures. Out of this influence and his own studies was born Anthroposophy, or the wisdom (knowledge) of the human being:*

At the heart of Anthroposophy is the recognition that the human being (Manushya) is a spiritual being (Purusha). Biodynamic agriculture was Steiner's answer to the farmers' call for help during the beginning of chemical farming in Europe when they noticed the rapid degeneration of the soil, of the quality of the produce, and of seed viability. They had been noticing a general decrease in vitality. Steiner then presented a different way of looking at cultivation and the Earth in general, showing the inter-relationship and connections between all living things.

He explained how modern science and therefore chemical agriculture was based on the study of dead things in laboratories, rather than on the observation of living nature and the complex relationships constantly changing therein. Among this web of life he also included the cosmos with its moving planets and stars, and he spoke of how in the past, farmers instinctively knew about the effects of this movement on the life of plants and also animals and human beings. As modern human beings, we must find this connection once more to understand how to work best with nature, but this time in a very conscious, measurable way.

Today there are many people around the globe who concentrate on understanding and recording the effects of the cosmos on our planet Earth, including Maria Thun in Germany who publishes a planting calendar for gardeners and farmers to use. Rudolf Steiner introduced a few preparations based on homeopathic medicine to enhance the beneficial cosmic influences on plants and the soil, and encouraged people to experiment and find new ones as well.

Life is a study of energy from the coarse to the fine, and Biodynamics is primarily concerned with the higher forces, the finer energies and how they influence plants, animals, and human beings. This knowledge and work with the life forces brings balance and healing to the soil, and therefore to anything that grows in that soil and every being that eats those plants.

Main effects of using biodynamic agriculture

- *to increase the vitality of food*
- *to regenerate natural resources such as the soil (by restoring the organic matter present in the soil), the seeds, and the water*
- *to create a personal relationship with the world in which we live, with Nature of which we are apart of, and to learn to work together*
- *most of all, to be of service to the Earth and its beings by aiding nature where it is weak due to constant use*

Effect of bio-dynamic manure on growth yield and quality of pigeon pea under climatic condition of Bindh region

Pigeonpea (Cajanus cajan (L.) Millsp.), commonly known as red gram or tur or Arhar, is a very old crop of this country. After gram, arhar is the second most important pulse crop in the country. It is mainly eaten in the form of split pulse as 'dal'. Seeds of arhar are also rich in iron, iodine, essential amino acids like lycine, threonine, cystine and arginine etc. Pigeonpea is predominantly a crop of tropical areas mainly cultivated in semi arid regions of India. Pigeonpea can be grown with a temperature ranging from 260C to 300C in the rainy season (June to October) and 170C to 220C in the post rainy (November to March) season. Pigeonpea is very sensitive to low radiation at pod development, therefore flowering during the monsoon and cloudy weather, leads to poor pod formation.

It is successfully grown in black cotton soils, well drained with a p H ranging from 7.0 - 8.5. Pigeonpea responds well to properly tilled and we ll drained seedbed. A deep ploughing with soil turning plough in fallow/waste lands, zero tillage sowing under intensive cropping system and Broad Bed Furrow/Ridge - furrow planting in low lying as well as intercropping areas is recommended. Raised Bed method of planting by dibbling at 2 inches depth with Row to Row distance 4 to 5 feet also 15 feet gap (2 pairs of Tur on bed) under intercropping of soybean under transplanting (Dharwad method/SPI), 5 X 3 and 3 X 1.5 feet spacing is recommended.

Keywords: *Pigeon pea, bio-dynamic, manure, yield, quality, Bindh, cropping, season, bedding, seeds.*

Introduction

The seeding rate of pigeon pea depends on the desired plant density for a genotype (early, medium or late), cropping system (pure crop, mixed crop, or inter crop), germination rate of seed and mass of seed.

Early Maturing Var. - 20 - 25 k g/ha (Row to Row - 45 - 60 cm & Plant to Plant - 10 - 15 cm)

Medium/Late Maturing Var. - 15 - 20 k g/ha (Row to Row - 60 - 75 & Plant to Plant - 15 - 20 cm)[1,2]

Three systems of sowings are practiced for pigeon pea. The common is flat sowing, the other methods are broadbed - furrow (BBF) for extra - early group and ridge-and-furrow for the late maturity group. Bund cultivation of pigeonpea in rice fallow areas have also been adopted in Bindh and some rice fallow areas.

The latter two methods are useful in fields with poor surface drainage and water logging. The raised beds or ridges also provide better aeration and nodulation in comparison to the flat sown crop. A broad bed and

furrow system is used for sowing extra-early genotypes, and ridges-and-furrows are used for medium and late duration genotypes.

The space between the rows could be profitably utilized by growing short duration crops such as urd, moong, cowpea, etc.

Important cropping systems followed are:

- Maize – Pigeonpea (Rabi)
- Pigeonpea - Urd - Wheat
- Pigeonpea - Sugarcane
- Mung + Pigeonpea - Wheat
- Pigeonpea (early) - Potato - urdbean

Pigeonpea is commonly intercropped with a wide range of crops. In India, it was estimated that 80 - 90 % of the pigeonpea were intercropped :

- With cereals (sorghum, maize, pearl millet, finger millet and rain-fed rice).
- With legumes (groundnut, cowpea, mung bean, black gram, soybean).
- With long-season annuals (caster, cotton, sugarcane, and cassava).[3,4]

The doses of biodynamic manure (cowdung and additional) fertilizers should be determined based on the results of soil test. All the fertilizers are drilled in furrows at a depth of 5 cm. and at the side of 5 cm. from seed. Apply 25 - 30 kg N, 40 - 50 k g P_2O_5, 30 kg K_2O per ha area as Basal dose at the time of sowing.

Secondary and Micro Nutrients

- Sulphur : In medium black soils and sandy loam soils apply 20 kg S ha-1 (equivalent to 154 kg gypsum/phospho-gypsum or 22 kg bentonite sulphur) as basal to each crop. If S deficiency is diagnosed red sandy loam soils, apply 40 kg S ha-1 (equivalent to 300 kg gypsum/phospho - gypsum/or 44 kg bentonite sulphur) per hectare. This quantity is sufficient for one crop cycle.
- Zinc : In sandy soil, apply 3 kg Zn ha-1 (15 kg zinc sulphate hepta hydrate/ 9 kg zinc sulphate mono hydrate) as basal. If Zinc deficiency found in the standing crop can then spraying 5 kg Zinc sulphate + Lime 2.5 k g dissolved in 800-1000 liter water per hectare.
- Iron : In light textured soils, foliar application of 0.5% $FeSO_4$ at 60, 90 and 120 DAS is recommended.

Being a deep rooted crop, it can to lerate drought. But in case of prolonged drought there is need of three irrigation.

- 1st at branching stage (30 DAS)
- 2nd one in flowering stage (70 DAS) and
- 3rd at the time of podding stage (110 DAS).

A pre-requisite for the success of pigeonpea is proper drainage. Ridge planting is effective in areas where sub-surface drainage is poor. Th is provide enough aeration for the roots during the period of excess rainfall.

The first 60 days is very critical and harmful for the arhar crop. Two mechanical weedings one at 20 - 25 days and another at 45 - 50 days after sowing but before flowering are required.

The Pre-emergence application of Pendimetha lin @ 0.75 - 1 Kg a.i. per ha in 400-600 liter of water kills the germinating seedlings of weeds and keep the field weed free for the first 50 days. If weed found from long time use Fluchloralin 50 % EC (Basaline) 1 kg of a.i per ha in 800-1000 liter well incorporated in the soil before sowing or Alachlor 50 % EC (Laso) 2 - 2.5 kg a.i. per ha in 400-500 liter of water as pre-emergence.[5,6]

With two third to three fourth pods at maturity judged by changing their colour to brown is the best harvesting time. The plants are usually cut with a sickle within 75 cm above the ground. Harvested plants should be left in the field for sun drying for 3-6 days depending on season.

Threshing is done either by beating the pods with stick or using Pullman thresher. The proportion of seed to pods is generally 50 - 60%. The clean seeds should be sun dried for 3-4 days to bring their moisture content at 9-10% to safely store in appropriate bins.

To avoid further development of bruchids and other storage pests, it is recommended to fumigate the storage material before onset of monsoon and again after the monsoon with ALP @ 1 - 2 tablets per tonne. The small quantity of the produce can also be protected by mixing inert material (soft stone, lime, ash, etc) or by smearing edible/non-edible vegetable oils or by mixing plant products like neem leaf powder at the rate of 1- 2% w/w basis.[7,8]

Discussion

With use of improved technology of agronomic practices pigeon pea may yield about 25-30 q/ha from irrigated condition and 15-20 q/ha from un-irrigated condition. (depending upon maturity group of variety and climate) and 50 - 60 q/ha of sticks for fuel, as well.

- Deep summer ploughing once in 3 years.
- Application of fertilizer should be based on soil test value.
- Seed treatment should be done before sowing.
- Use wilt and Sterility Mosaic disease (SMD) resistant /tolerant varieties BSMR 736, 853, 846, ICPL 96053, BDN 2010, ICPL 43, 44, IPA 203, 204, 234 and IPH 09 - 5 as per suitability of region. (IIPR AICRP Pigeonpea).
- Wilt resistant varieties VL Arhar - 1, Vipula, JKM - 189, G.T. - 101, Pusa 991, Azad (K - 91 - 25), BSMR - 736, M A - 6 etc.
- Use hybrid varieties PPH - 4, ICPH - 8, IPH 09 - 5, ICPH - 2740 as per suitability of region.
- Weed control should be done at right time.
- Adopt integrated approach for plant protection

Use of green manure crops is an ideal preposition for soil enrichment. In Maharashtra pre-monsoon shower starts by the end of May. Taking advantage of such showers sprinkle 1-2 kg seeds each of Sunhemp, Sesban, Horse Gram, Cow pea, Green gram and Black gram and allow them to grow for 30 days. Incorporate this green manure crop into the soil by shallow tilling during first week of July and go for red gram sowing after 7-8 days of incorporation. Addition of 5-10 quintal Neem leaf/seed manure has also been found to be beneficial not only in terms of increased nutrient supply, but also in terms of reduced problem of soil borne pathogens and nematodes .[9]

"Sanjeevak", a fermented liquid manure prepared from cattle dung and cow urine is a key on-farm input in fertility management of soils under organic management. Amrutpani, a soil tonic can also be used in place of Sanjeevak. 200 lit of Sanjeevak/acre is applied on soil either along with the irrigation water or sprinkled over the soil surface during or after mild rains. Minimum of three applications of Sanjeevak are necessary. First at the time of sowing, second after 25-30 days (after first weeding) and third after 50-60 of sowing (after second weeding).

For better crop growth, "Jeevamrut" (Life tonic) is used as foliar spray, at least on three occasions with an interval of 20 days after 20 days of sowing. In south Indian states farmers use Panchgavya in place of Jeevamrut as foliar spray .

Results

Pigeon pea (*Cajanus cajan*) is a hardy perennial legume crop but occasionally annual shrub and its growing periods are different depending on cultivar. It can be intercropped with cereals like wheat and used as a shade crop for young trees and also can use for green manuring. Green manuring enhances the soil incorporation of several fields or scavenge crop while green or rapidly later than flowering for the reason of soil improvement (Sullivan, 2003). They are also considered as effective alternatives to compound fertilizers in the organization and conservation of soil fertility and productivity. Uniqueness of green manures includes a crop that is quick rising with fast decomposition and rapid nutrient release (Leinonen, 2000). Green manuring is mainly the inexpensive means of mounting up organic matter content of the soil. It may be applied in a straight line, leaving it on the soil as mulch or composted before function and can serve up a dual point as a source of green manure and food. Some green manures can be utilized as animal feed by means of resulting animal manure employed as fertilizer. A new focal point is the production of fibers or forages allowing for greater in addition to different uses of green manure and an increase in its advantages[10]

The meaning of nitrogen for privileged yield has long been predictable in Pakistan wherever most soils are deficient in nitrogen for the cause so as to great outflow. Shortage of nitrogen directs to reduce protein combination, chlorophyll and nucleic acid formation (Shah et al., 2003). Nitrogen is one of the important plant nutrients; it is continuously a limiting issue of plant growth and yields. Its vulnerability to losses is intimately associated to manage the vegetative growth of plant and therefore settle on the chance of reproductive sequence and ultimately yield. The production of the crop significantly affected by optimum method, time and level of nitrogen application. The lower crop yield and poor growth resulted because of the higher nitrogen requirement than soil supply in Pakistan, improper application method and, its sub-optimal application level by farmers

The release of nitrogen from green manures could be utilized by means of subsequent wheat crops right through their mounting stage. Consequently, the nitrogen received in a while mounting stage enhances grain protein contents Considerable quantities of nitrogen are practiced into soil via green manures, but nitrogen is on the rampage steadily with long-standing breakdown of natural material, as a result lessening the hazard of escape nutrients. Keeping in view the importance of green manuring and N application current study plan was made to evaluate the pigeonpea green manuring effect on performance and subsequent N fertilizer requirement of wheat crop.[8,9]

Two years field experiments titled to evaluate the effect of pigeonpea green+biodynamic manuring on performance and subsequent nitrogen fertilizer requirement of wheat crop were conducted at Newly Developed Research Farm of the University of Agriculture Peshawar in 2013-2014. The soil was silty clay loam with pH of 8.02 and low organic matter contents of 0.844%. The trials in both years were carried out in RCB design with split-plot arrangements having four replicates. Pigeon pea green manuring treatments were allotted to main plots, where crop was incorporated in soil at different days after

emergence (DAE), this was done in previous season before sowing of wheat crop, whereas the nitrogen levels were allotted to sub plots as:

Pigeonpea green manuring with biodynamic manure	Nitrogen levels
M_1 = Control	N_1 = Control
M_2 = 30 days after emergence	N_2 = 30 kg ha^{-1}
M_3 = 60 days after emergence	N_3 = 60 kg ha^{-1}
M_4 = 90 days after emergence	N_4 = 90 kg ha^{-1}
M_5 = 120 days after emergence	N_5 = 120 kg ha^{-1}

Conclusions

Based on the results obtained, it is concluded that the incorporation of biodynamic and green manures 90 and 120 days post emerged pigeon pea improved plant growth and yields of wheat crop during both the years. Application of N fertilizers at the rate of 120 kg N ha^{-1} improved the growth of wheat while some parameters were also similar when 90 kg ha^{-1} N was used. In case of combine use of green manuring and nitrogen fertilizer results showed that wheat crop performed very well in those plots which were treated with 90 days post emerged pigeon pea and 90 kg nitrogen ha^{-1}. Results indicating that synthetic nitrogen requirement can be reduced with the use of biodynamic and green manuring, which is a good approach towards batter and sustainable agriculture.[9,10]

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