

Management of frost in pigeon pea for higher production

Adikant Pradhan¹, S.K. Patil² and H.L. Sonboir³

S.G. College of Agriculture and Research Station, Jagdalpur, Chattisgarh

Today pigeon pea is widely cultivated in all tropical and semi-tropical regions of both the old and the New World. Pigeon pea can be of a perennial variety, in which the crop can last 3-5 years (although the seed yield drops considerably after the first two years), or an annual variety more suitable for seed production. Pigeon pea is drought resistant and can be grown in areas with less than 650 mm annual rainfall. Greater attention is now being given to high demand at remunerative prices.

PIGEON pea is an important legume crop of rain-fed agriculture in the semi-arid tropics. The Indian subcontinent, Eastern Africa and Central America, in that order, are the world's three main pigeon pea producing regions. Pigeon pea is cultivated in more than 25 tropical and sub-tropical countries, either as a sole crop or intercropped with cereals such as sorghum, pearl millet, upland rice or maize, or with other legumes, such as peanuts.

Being a legume, the pigeon pea enriches soil through symbiotic nitrogen fixation.

The crop is cultivated on marginal land by resource-poor farmers, who commonly grow traditional medium- and long-duration (5-11 months) landraces. Short-duration pigeon peas (3-4 months) suitable for multiple cropping have recently been developed. Traditionally, the use of such input as fertilizers, weeding, irrigation, and pesticides is minimal, so present yield levels are low (700 kg/ha). About 82% is grown in India and these days it is the most essential ingredient of animal feed used in West Africa, more

especially in Nigeria where it is also grown.

Pigeon pea is both a food crop and a forage/cover crop. It contains high levels of protein and important amino acids (Methionine, lysine, and tryptophan) In combination with cereals, pigeon pea makes a well-balanced human food. The dried peas may be sprouted briefly, and then cooked, for a flavour different from the green or dried peas. Sprouting also enhances the digestibility of dried pigeon peas via the reduction of indigestible sugars that would otherwise remain in the cooked dried peas. In India, split pigeon peas (*toor dal*) are one of the most popular pulses, being an important source of protein in a mostly vegetarian diet. In regions where it grows, fresh young pods are eaten as vegetable in dishes such as *sambhar*. Pigeon pea is in some areas an important crop for green manure, providing up to 40 kg nitrogen per hectare. The woody stems of pigeon peas can also be used as firewood, fencing and thatch.

Frost damage to Arhar crop

Severe winter weather conditions can create many problems for crop plants jeopardising their health and

even their lives. The frost can significantly damage different parts of the plants resulting in low agricultural productivity. Various measures can be taken to tackle this problem.

Effects of frost

Frost occurs when temperature around the plant drops below 0°C. At this temperature, water turns into ice crystals on the surface of the plants. Frost can injure active tissues that are insufficiently hardened to withstand the cold temperatures which may lead to stunted growth and even death of plants. Flower buds, vegetative buds, branches, stem, crowns, bark, roots, or even the whole plant may be injured by frost.

Winter desiccation commonly called "winter drying" or "winter burn, occurs due to intensity of frost spells. During severely cold weather, the ground may freeze to a depth beyond the extent of the root system, thereby cutting off water supply to the plants. Injury due to desiccation is commonly seen as discoloured, burned leaves or whole plant. It is worst on the side facing the wind thus causing extra damage. Frost prevents plants from having firm contact with the soil

¹ and ³ Scientists, AICMSIP, ²Dean



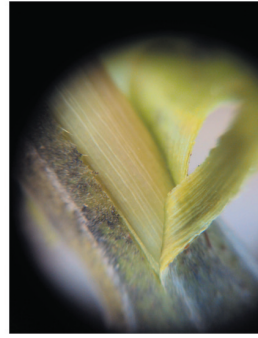
Frost affected field of arhar



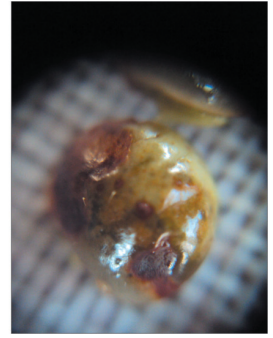
Burned leaves and flower



Discoloured stem



Healthy stem of arhar



Frost affected seed of arhar

and exposes the roots to wind desiccation.

There are many factors that affect the actual critical temperature for a given plant and the amount of frost injury, like duration of cold; growing conditions prior to the cold event; cultivars (because of plant habit, or avoidance, rather than genetic differences); stage of development; super cooling (in the absence of ice nucleation points, plant sap can cool below the freezing point without forming ice crystals); soil type and condition (moist dark soil holds more heat than dry light soil); Incidence of freezing wind; soil moisture and compaction. This can have a significant effect on temperature. A moist compact soil will store more heat than a loose dry soil and therefore has more heat to transfer to the crop at night. Cultivation just before the frost can increase the risk of injury, because the soil is looser and drier after cultivation. Soil under a grassy cover crop will hold more heat if the grass is mowed short.

Management of frost

Irrigation

Although it is difficult to manage frost occurrence in crops, different practices can be helpful in this respect. Proper revised irrigation schedule can be helpful to cope with low temperature injury.

Irrigation frequency should be increased in case of heavy frosts with less amount of water per irrigation. This will moisten the soil resulting in more uptake of water by plants. This water will help the plant sap to move efficiently from leaves to other plant parts.

One negative side effect of more frequent irrigation for frost protection is increased potential for disease outbreaks. Pathogens of many diseases grow rapidly in moist and humid conditions.

Mulching

Mulching is one of the most important ways to maintain healthy plants under frosty temperature. Mulch is any material applied to the soil surface for protection or improvement of the area covered. Mulches keep the soil cooler in summer and warmer in winter, thus maintaining a more even soil temperature. Mulch such as dried grass clippings, hay or straw, leaves can be used temporarily to cover tender plants to protect arhar from frost injury.

Modify the micro-climate

Another approach to modify the micro-climate to enhance plant productivity by plastic material is the use of row covers. Row covers may be used during the cold season; To conserve warmth, stimulate germination and early

growth; protect plants from frost injury, and improve the quality of the crops; row covers reduce evaporative cooling and the rate of cooling under the cover.

Protect from desiccation injury

It can be minimized by placing a protective barrier and wind breaks over or around plants to protect them from winter winds. Sun helps to reduce the incidence of this injury. Anti-desiccant sprays applied once in late autumn and again in mid-winter may also prove helpful.

It is a better option in temperate region to grow crops under green house conditions to circumvent heavy frost. Plastic sheet will conserve and retain the temperature trapped inside the tunnel at the day time. This is due to the accumulation of CO₂ gas in the inner climate.

SUMMARY

The frosty temperature causes serious damage to crop plants. Since it is a natural phenomenon, it can not be wiped out but can be managed through various means like proper irrigation, row covers, mulching, protective barrier and wind breaks and green house cultivation. All these practices are economically diverse but have good impact on crop productivity.



Indian Farming

*Wishes grant success of
Krishi Vasant*

National Agriculture Fair cum Exhibition, Nagpur