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A comprehensive review on: Effect of mulch in bulb crops

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Abstract
Onion and garlic are most ancient bulb crop for human being. To maintain the expansion of our agricultural produce, use certain approaches which may be accomplished through conservation farming, and one of the best methods in this regard is the method of mulching used in agriculture. To conserve soil moisture, to increase soil temperature, to supress the weed growth, to increase production, improve quality, to prevent pest attack, to promote early harvest much is most effective treatment. In inorganic Black and silver polythene mulch gave the best result in quality and yield as well as cost effective material that mostly used by farmers. On the other hand, organic mulch improves the fertility and gave effective results towards yield and quality. This review aimed to combine existing research on mulches and various types of mulching materials being used in horticulture crops in various climate conditions using diverse methodologies.

Keywords: Onion, garlic, leek, mulch, organic mulch, in-organic mulch

Introduction
Most ancient crops in bulb family are Onion, garlic and leek which are edible and belongs to Alliaceae family. Allium is the most commonly cultivated in the Alliaceae family (Mnayer *et al*., 2014) [19]. In Egypt onion bulbs and models of garlic bulbs has been found before 5000 years. Onions (*Allium cepa* L.) and garlic (*Allium sativum* L.) are highly prized vegetable crops that are used in both traditional and modern medicine. Both of these crops are widely grown across the globe's latitudes and longitudes. The necessity to increase onion output is due to the ever-increasing demand for this crop.

Onion (*Allium cepa* L.) is one of India's most important vegetable crops. The medicinal effects of onions have been discussed in the Sanskrit medical text "Charak Samhita." India is second only to China in terms of onion production and area. Onion is used as a raw or as a cooked vegetable. most important factor of onion is it flavour that increase the taste of regular meal like gravies, soups, fried fish, meat (Rahim, 1992) [26]. In recent years, the onion production in our country has increased significantly. It is a widely growing crop that can be used in any climate or by any nationality. Maharashtra, Madhya Pradesh, Karnataka, and Gujarat are the major onion-producing states. Onions have a long history of folk treatments, and it may help to avoid heart disease and other disorders. (Augusti, 1990). In edible portion of 100 g onion contains moisture 86.8 g, carbohydrate 11.09 g, protein 1.2 g, fibre 0.6 g, mineral 0.4 g, thiamine 0.08 Mg, Vit. C 11 Mg, calcium 180 mg, phosphorus 50 mg, iron 0.7 mg, nicotinic acid 0.4 mg, riboflavin 0.01 mg (Aykroyd, 1963) [4].

Garlic (*Allium sativum* L.) is a member of the Amaryllidaceae family. Garlic is grown largely for its cloves, which are used as a flavourful ingredient. Garlic is one of mankind's oldest medicinal plants (Lewis and Elvin, 2003; Younis *et al*., 2010) [17, 36]. However, many farmers in northern Iran grew this crop for its leaves, which were used in a variety of regional recipes (Olfati *et al*., 2010) [24]. Garlic is the most extensively used as a popular culinary component and for medical uses (Khalid *et al*., 2014; Nicastro *et al*., 2015) [13, 23]. In addition to carbohydrates, it contains, polyphenols, minerals, carotenoids, vitamins and antioxidants (Liu *et al*., 2014) [18]. Garlic produces a chemical compound known as allicin which is responsible for its pungent smell. Diallyl disulphide, diallyl trisulphide and allicin, appeared to be the chief antioxidant compounds in the garlic volatiles (Kim *et al*., 1997) [14]. Garlic possesses antiviral, antibacterial, antifungal, and antioxidant properties, confirming its reputation as a healthful vegetable. There were also anti-atherosclerotic and anti-cancer capabilities. In 100 g of garlic cloves contains 62.82 g moisture, 6.3g protein,29g carbohydrate, 1g minerals,0.30 g phosphorus, 0.03 g calcium, 13mg vitamin C, 16mg vitamin B, 0.23 mg riboflavin, 0.06mg

thiamine (Bose and som, 1986) [8]. Because of ever increasing demand of onion and garlic, there is need to enhance the production of this crop.

Mulches

The word mulch derives from German word "molsch" which means "soft". Mulches are the materials that are utilised to cover the surface of the soil. Mulches are applied in agriculture for a variety of reasons, but the most essential goals are water saving and erosion control, especially in dry and semi-arid areas. Mulching can also help with weed control, soil conservation, protecting plant roots from heat, cold, and draught, supplying plant nutrients after organic mulch breakdown, enhancing soil structure, and improving crop quality and yield. Soil mulching has been proven to reduce soil evaporation by 45 percent, total evapotranspiration by 5%, and increase water efficiency by up to 13%. (Zhang *et al*., 2018) [37]. Mulching prevents soil deterioration by minimizing runoff, soil loss, weed infestation, and water evaporation. As a result, it improves the physical, chemical, and biological features of soil, adds nutrients to soil, and eventually promotes crop development and production. (Kumar *et al*., 1990) [9]. Mulch can also help in water conservation, soil erosion, weed control, and nutrient loss. (Van Derwerken and Wilcox, 1988) [34]. Two types of mulches are available, organic and inorganic.

Organic mulches are made from plant and animal resources such as straw, grass, peanut husk, leaf mould, compost, sawdust, wood clips, and animal manures. Organic mulch Reduces nitrate leaching, improves soil physical characteristics, prevents erosion, provides organic matter, regulates temperature and water preservation, improves nitrogen balance, participates in the nutrient cycle, and increases biological activity. (Hooks and Johnson, 2003; Muhammad *et al*., 2009; Sarolia and Bhardwaj, 2012) [11, 21, 29, 30]. natural mulch does have some fertiliser value and is a good soil conditioner.

In-organic mulch is the most commercially used in crop production. In plastic material Polyvinyl chloride and polythene mulch are most commonly used. For horticultural crops, polyethylene film mulch is used for mulching (Bhardwaj *et al*., 2012) [29, 30]. Plastic greatly minimises weed growth and, reduced weeding costs. It also increased soil temperature, allowing plants to mature earlier (Miles *et al*., 1998). Cultivated under plastic mulch, all of the crops showed considerable advantages in growth, early maturity, yield, and quality (William and Lament, 1995). Although every kind of material can be used as a mulch by theory, but only a few are better suited for horticultural crops in fact. The mulching material used would, however, be determined by its ease of availability, appropriateness, efficiency, and cost.

Effect of mulch on growth parameter

Mulching creates a favourable environment for growth, resulting in plants that are more vigorous and healthier. Mulched plants mature and develop better than unmulched plants, reducing soil evaporation by 45 percent, total evapotranspiration by 5%, and increasing water use efficiency by up to 13% (Bhardwaj *et al*., 2011; Sarolia and Bhardwaj 2012) [6, 29, 30]. Mulched treatments had considerably higher total N, P, and K uptake than unmulched treatments (Acharya and Sharma, 1994) [2]. Mulch treatment gave more tiller per plant and a greater number of leaves per plant in shallot crop, it also found that in clear plastic mulch the number of leaves per plant 47 is more than control 35, silver plastic mulch gave the highest plant height and number of tillers in shallot crop (Sopha and Efendi, 2021) [32]. When compared to bare soil (85 percent survival rate), black plastic offered better winter protection for garlic (95 percent survival rate) (Yimer, 2020) [35]. Black polyethylene mulch produced the tallest plant, more leaves per plant, the greatest fresh weight of leaves, followed by water hyacinth and straw mulches (Slam *et al*.,2007) [31]. Plants with any type of mulch increased plant height, number of leaves per plant, leaf length, pseudo stem length, number of roots per plant, clove number per bulb, 100 clove weight, bulb and neck diameter much more than control plants (Baten *et al*., 1995) [5].

Effect of mulch on yield

Mulches are very effective toward the crop production and also increases the farmers economy. Lasmini, and Wahyudi 2018, reported that the Different bulb yield response to various mulch. Clear plastic mulch achieves higher bulb yield (30% more than unmulched plot) due to highest biomass contain and weed suppression (Sopha and Efendi, 2021) [32]. Bulb yield and plant biomass have a significant relationship (Abdissa *et*. *al*., 2011) [1]. Garlic cultivated on black plastic produced more marketable weights and bulb diameters than garlic grown in bare soil with wheat straw mulch (Yimer, 2020) [35]. Black polyethylene mulch produced the largest diameter of bulb, the largest dry weight of bulb, and the largest bulb weight, followed by water hyacinth and straw mulches (Slam *et al*.,2007) [31]. Straw mulches produced the most cloves, highest bulb weight, and production per 10 bulbs, followed by plastic, sawdust mulches, and control (Jamil *et al*., 2005) [12]. When compared to saw dust, both straw and plastic mulches produced the highest yield of garlic crop, although straw mulch performed better overall. It is also less expensive and more natural (Yimer, 2020) [35]. Garlic bulb output and quality were observed to be improved by soil mulching, yield increased by up to 140 percent (Moravcevic *et al*., 2014) [20].

Effect of mulch on quality

In shallot silver plastic mulch increase bulb diameter in respect to other mulch treatment (Sopha and Efendi, 2021) [32]. Mulches not only increase bulb output, but they also improve some quality indices including ash percent, TSS, and vitamin A (Najafabadia *et al*., 2012) [22]. In the onion crop, moisture conservation for straw mulch treatments ranged from 4.0 to 4.5 cm, which was 0.4-0.6 cm higher per irrigation than the control. Mulching the irrigated onion crop with clear polyethylene sheet levels of soil temperature by 10 to 6.35 °C at 5 and 20 cm depths, over the unmulched one (Shanawany *et al*., 2003) [10]. Irrigation and mulching have a significant impact on onion maturation and growth (Rahman *et al*., 2013) [27]. Mulching with paddy straw, sawdust, and neem leaves was found to effectively control weed growth in onions (umar *et al*., 2000). The effect of mulches on onion morpho-physiological properties was studied, and it was discovered that mulches had a substantial impact on dry matter accumulation, leaf area index (Rahman *et al*., 2001) [28]. Various mulches have a considerable impact on the T.S.S. content of onion bulbs, It was highest in plots with black plastic mulch, followed by sugarcane garbage mulch, and lowest in plots without mulch (Parsottambhai and Rawat, 2020) [25]. Different mulches have an effect on onion dry matter accumulation. Organic mulch enhanced onion bulb

size, growth, and all agronomic metrics (Anisuzzaman *et al*., *2009)* [3].

Conclusion

It concludes that, different mulch has different potential that can be gave too beneficial. Use of mulch had great impact on yield, growth and quality parameters. Different researchers revealed that mulch gave the great result as compare to unmulched. Mulch helps to improve soil quality, soil fertility, also decrease weed growth, conserve moisture and gave protection to plants towards cold and heat stress condition. Mulch helps to improve farmers income and also increase production and productivity. So, the positive impact of mulch on higher crop production revealed by some scientist had been summarised above.

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