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Effect of mulching on growth, yield and quality of onion (*Allium cepa* L.): A Review

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Abstract

As the population of India continues growing, we have to implement some techniques to sustain the growth of our agricultural production and it can be achieved by conservation farming and in this regard, one of the best method is old age method of mulching practiced in agricultural community. Mulching became useful method in current agriculture production in terms of increase or decrease in soil temperature, moisture conservation, reduction in weeds, increase in crop yield, decrease in some of insect pest and also good for conserving soil nutrients. In mulching, plastic mulch, especially black plastic polyethylene are mostly used due to its good result, minimal prize and some biodegradable mulches are also used because it can be left in filed after harvesting of crop but they are more costly than plastic mulch and less durable than polyethylene. In this review paper, an attempt has been made to compile the published research work on mulches and various kind of mulching materials used in horticultural crops in different climate conditions according to different approaches.

Keywords: onion, mulching, growth, quality, yield

Introduction

Onion (*Allium cepa* L.) belonging to the family alliaceae is the one of the most important bulb vegetables of India also known as garibo ki kasturi. It has been first domesticated in the mountains of Turkmenistan, northern Iran and Afghanistan ^[1]. It is mainly grown in India during rabi season and harvested in summer season and stored and supplied according to demand. India is the second largest producer of onion after China. Onion is semi perishable in nature and is used as salad, in curries, chutneys and pickles. Onion is grown in an area of 12.63 lakh ha with a production of 2.35 crore MT ^[2]. Crushed bulb of onion is colorless, odorless and volatile compound present is allyl propyl disulphide. The outer skin color is due to quercetin. It is the most needed vegetable crop grown in India. Onion is a photothermo-sensitive crop and requires specific temperature and day length for vegetative growth and bulb development. In Maharashtra, onion can be taken in rabi, kharif and late kharif season. In kharif season, there are heavy rains and weather is cloudy which favours weed growth, attack of pest and diseases like thrips and purple blotch, respectively. Other problems are poor keeping quality, rotting and sprouting losses during storage. Onion is mostly grown in India in winter season and harvested in summer, stored and supplied according to need but there is a critical gap of onion from the month of October to December and due to this shortage, price of onion increases, therefore, kharif onion is important as it stabilizes the prize and demand during this critical period.

Onion is mostly packed with nutrients and is high in vitamins and minerals. It is a rich source of vitamin C which acts as a strong antioxidant in human body, protects cells against free radicals. Onion also have chemical properties of folate and pyridoxine which is helpful in metabolism, red blood cells and nerve function. It is also a good source of potassium.

Amount per 100 g of edible portion ^[3].

Moisture	86.4 g	Calcium	180 mg
Protien	1.2 g	Nicotinic acid	0.4 mg
Vitamin C	11 mg	Phosphours	50 mg
Carbohydrates	11.09 g	Riboflavin	0.01 mg
Dietary fiber	0.6 g	Iron	0.7 mg
Mineral	0.4 g	Thiamine	0.08 mg

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Mulches

Mulches are the materials used to cover the soil surface. There are two types of mulches available, organic mulch and inorganic mulch. The use of mulch in onion is an accepted practice in Western countries. It conserves soil moisture, suppresses the weed growth, regulates the soil temperature, improves the soil structure and checks the soil erosion. Mulching also helps in establishment of seedling and plant growth. Benefits of plastic mulch are probably associated with better diurnal pattern of soil temperature and wider canopy air temperature. Plastic mulch reduces weed infestation and ultimately the cost of weeding. Theoretically, any type of material can be used as a mulch, but in practice, only a few are more admirably suited for horticultural crops. They being as varied as plant residues which include dry leaves, corn stalks, saw dust, grain straw, hay, pine needles, cane trash, wood wool and materials like asphalt paper, glass-wool, Al-foil, bituminous emulsions, polyethylene plastic etc. Choice of mulching material would, however, depend upon its easy availability, suitability, efficiency and economy. This review provides an overview on the current research prospects and efficiency of using synthetic mulches, such as white polyethylene, black polyethylene and organic mulches such as sugarcane trash, straw mulch that have been used in onion to increase the yield as well as quality of onion.

Effect of mulches on plant growth parameters

Use of different kind of mulches such as transparent polythene, saw dust, rice straw, black polythene and water hyacinth in crop of onion and garlic reported that they conserve soil moisture efficiently as observed by many workers [4]. The higher biomass production of onion is observed in polythene mulched plot beside natural mulches [5]. Mulches such as polythene and rice straw were precisely good in increasing growth and yield of onion crop [6]. The outcome of few type of mulches on yield and growth of onion and reported that height of plant was 54.0 cm at 60 days after transplanting under black polythene mulch with holes while, significantly maximum marketable yield per hectare (39.6 t/ha) was observed in mulching with sugarcane trash, which was at par with black polythene (36.0 t/ha) [7]. Numbers of leaves per plant were significantly reduced with groundnut shell and saw dust mulches while length of leaf was maximum with polyethylene mulch and minimum with sawdust [8].

Effect of mulching on morpho-physiological characters of onion and revealed that the dry matter accumulation, leaf area index, plant height and root length was notable affected by mulches [9]. Mulching helped in the accumulation of organic matter content, uptake of soil nutrient and control of soil temperature and also helped in controlling soil erosion [10].

Effect of mulches on yield and yield related parameters

Mulched the irrigated onion field with transparent polyethylene film and found significant increase in growth, yield and quality of onion plants grown in mulched plots over other plots. Bulb yield increase over that of shaded ones was 97.05 per cent and 18.03 per cent for mulched and unmulched plots, respectively [11]. Highest polar length of onion bulb (5.59 cm) and highest onion bulb diameter (7.58 cm) were obtained with polyethylene mulch followed by millet chaff mulch, groundnut shell and the lowest values were recorded under saw dust including control [8]. Influence of mulching on irrigated and non-irrigated yellow onion cultivars and reported that the mulching treatment with furrow irrigation

gave the highest value of bulb length and bulb diameter [12]. The bulb yields as well as few other agronomic parameters were greatly influenced with mulching [13].

Yield of bulb in black polythene mulch was higher due to large size of bulb production, while the bulb yield was lowest in un-mulched or control plant (6.06 t ha⁻¹) [14].

Polyethylene mulch material practiced by groundnut shell, Mulch material applied plots required the least amount of irrigation water and produced highest bulb yield [8].

Mulching of different types of organic materials like chopped grass and clover material improved significantly the plant development, plant growth and also increased bulb yield of onion [15]. With white plastic mulch the highest bulb yield was observed from no mulch and other application [16]. Onion yield was remarkably higher, bulbs were larger and harvest was earlier for crops grown using the white plastic mulch in comparison with no mulch and other mulch application [17].

Effect of mulches on quality parameters

Organic mulch such as andropogon grass enhanced and improved the productivity of tiny and medium size onion in Guinea savannah zone of Ghana [18]. Moisture retention for straw mulch treatments in onion crop varied from 4.0 to 4.5 cm which was 0.4-0.6 cm per irrigation higher compared to no mulch. For maturity of crop total 16 irrigations were required as a result 6.4-9.6 cm of water could be saved [19]. Mulched the irrigated onion field with transparent polyethylene sheet and revealed that mulching increased soil temperature by 10 to 6.35 °C over un-mulched one at 5 and 20 cm depth, respectively [11].

The most absolute growth rate (ABR) was sustained in the onion crop using the applicable polythene mulches amid the growth time and the least absolute growth rate was observed in without mulch [20]. In onion maturity and growth is considerably determined by irrigation and mulching [21]. Mulching using paddy straw, saw dust, neem leaves were observed to suppress weed growth effectively in onion [22]. The effect of mulches on morpho-physiological attributes of onion and reported that the dry matter accumulation, leaf area index, plant height and root length were significantly influenced by mulches [9].

T.S.S. content of onion bulb was significantly influenced due to various mulches. It was recorded highest under black polyethylene mulch followed by sugarcane trash mulch and lowest under un-mulched plots [23]. The dry matter accumulation was affected by different mulches in onion [9]. Bulb size, development and all agronomic parameters of onion were improved by organic mulch [14].

Conclusion

The beneficial effects of different mulching reported by different researchers has been summarized above. Research has shown that mulches give so many benefits to plant production. It also protects plants from different climatic conditions such as heat and cold, different mulching material increase yield, quality and growth, it also suppress weed growth. Therefore, in coming days farmers can use this technique to reduce weed, conserve moisture and improve soil health while producing more yield. This will give long term security for production and conservation.

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