

4 Discussion

4.1 Effect of mulching on vegetative growth

The results clearly showed that mulching improved vegetative growth compared with the unmulched control. Rice straw mulch produced the tallest plants and the longest leaves, while plastic mulch resulted in the highest number of leaves. These improvements suggest that mulching created a more favorable environment for onion growth during the growing season. Mulch generally reduces water loss from the soil surface and suppresses weed growth, allowing plants to use available water and nutrients more efficiently. Since soil moisture and temperature were not measured in this experiment, these factors cannot be confirmed directly, but they are likely to have contributed to the observed differences.

The better performance of rice straw mulch may also be related to its gradual decomposition during the cropping period. As the mulch breaks down, it can improve the soil surface environment and provide a small amount of nutrients to the crop. Similar responses have been reported by Ramakrishna et al. (2006), who found that straw mulch improved crop growth by conserving soil moisture and enhancing soil conditions. Likewise, Mutetwa and Mtaita (2014) reported improved vegetative growth of onion under organic mulching compared with bare soil.

4.2 Effect of mulching on bulb development and yield

The improvement in vegetative growth was reflected in bulb development and final yield. Plastic mulch produced the highest bulb weight, bulb diameter, stem diameter, and total bulb yield, whereas the control consistently recorded the lowest values. Onion bulb development depends largely on the plant's ability to produce and transfer photosynthates from the leaves to the bulb. Therefore, treatments that supported better leaf growth were also able to produce larger bulbs and higher yields.

Rice straw mulch also performed well and produced significantly higher yield than the control. Although its yield was lower than that of plastic mulch, the difference was relatively small considering that rice straw is an inexpensive and locally available material. This suggests that rice straw can be a practical alternative for farmers who wish to improve onion production without relying on plastic mulch.

Root length was not significantly affected by the treatments. This indicates that the increase in yield was more closely related to improvements in above-ground growth and bulb development than to changes in root elongation.

4.3 Comparison with previous studies

The findings of this study agree with several earlier reports showing positive effects of mulching on onion production. Islam et al. (2007) and Najafabadi et al. (2012) also reported higher bulb yield under plastic mulch than under bare soil. Similarly, Ramakrishna et al. (2006) found that organic mulches improved crop performance by reducing evaporation and creating more favorable soil conditions.

However, the magnitude of yield improvement observed in the present study differs from some previous reports. Such differences are expected because crop response to mulching depends on several factors, including climate, soil type, irrigation method, cultivar, and mulch characteristics. In this experiment, onion was grown under the subtropical conditions of western Nepal using flood irrigation, whereas many previous studies were conducted under different environmental conditions and irrigation systems. These differences may explain the variation in yield response among studies.

4.4 Agronomic implications

Among the tested mulching materials, plastic mulch was the most effective for maximizing onion yield. Nevertheless, its use also raises concerns about the disposal of polyethylene after harvest and the possibility of plastic residues remaining in agricultural fields.

Rice straw mulch offered a good balance between productivity and sustainability. Although it produced a lower yield than plastic mulch, it substantially outperformed the control and other organic mulches. Because rice straw