



REVIEW ARTICLE

RESPONSE OF WHEAT PARAMETERS TO SOWING DATE AND IRRIGATION SUPPLIED IN TERAI REGION OF NEPAL

Shreya Aryal, Bishwash Dhungel, Khem Raj Subedi, Pawan Lamichhane, Sulav Bhattarai

Institute of Agriculture and Animal Science, Paklihawa Bhairahawa, Nepal

*Corresponding Author Email: shreyaaryal572@gmail.com

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ABSTRACT

Wheat (*Triticum aestivum* L.) is one of the most important staple food crops all around the world. It belongs to the family Poaceae. It has high dietary fiber content and is the good source of carbohydrate due to which it has wide cultivation in the entire world. It is the 3rd most cultivated commercial crop in Nepal. It is most popular among terai region due to suitable climate and irrigation supply. Wheat is generally a winter season crop and its growth and yield highly depends upon various factors where sowing time and irrigation requirements are the major ones. Wheat sown at appropriate time with average water supply and minimum to average temperature contributes to high production. Sowing in time leads the wheat to absorb adequate sunlight and harness it for increasing the production. Similarly, 6-7 irrigation supplied during the growth contributes to higher yield and good grain quality of wheat. With the advancement in technology improved seeds have been introduced in Nepal which are disease resistant. But still water stress resistant wheat varieties have not been introduced and researches are going on. So, sowing on time and providing irrigation is very important for good response of growth parameters and to attain maximum productivity of wheat.

KEYWORDS

Sowing Time, Irrigation supply, yield parameters

1. INTRODUCTION

Wheat is the important commercial food crop of Nepal. It ranks in third position in Nepal on the basis of area of production and amount of production. Wheat cultivation varies widely from Hilly areas to Terai Region in Nepal. The economic survey data 2019 has shown that wheat population in Nepal has increased from 265 tonnes (in 1970) to 1786 tons (in 2019) with the annual growth rate of 4.74%. For most of the people in Terai region of Nepal Wheat cultivation is the only way to earn for their day to day life. With the rapidly increasing population of world topic of food security is being raised. Wheat consumption rate is high due to which its demand is also increasing accordingly. To fulfill the human demand and solve food security problem it is very important to follow good techniques for more production. Yearly, Nepal imports huge quantity of wheat due to insufficient production in Nepal. However, wheat production rate has increased in past few years.

Recently various improved varieties of wheat have been introducing in Nepal which can be grown all year round that sustains the climate and various environmental factors but wheat is basically known as winter season crop. It is grown from temperature ranging from 15°C - 22°C. It generally grows well in cold and dry weather but supplementary irrigations are required at various growth stages for proper growth, high yield and quality grain. Good production of wheat aids in the economy of

the country. With the climate change temperature is rising all over the world and so in Nepal which is causing irregular temperature, rainfall and is affecting in seasonal change. Water is found to be the major influencing factor for wheat production and water stress resistant variety has not been introduced et so water management is very necessary (Poudel et al., 2020).

Most of the research have shown that wheat sown at suitable time and with supply of light irrigation has resulted in higher yield (Ali, 1999). Sowing time is directly related to the climatic conditions at that time and precipitation. So, sowing time and irrigation supplied effects in the growth stages of wheat like tiller/plant, no. of spikes/spikelet's, ear length, dry matter, grain yield, biological yield, harvest index etc. Very early sown wheat also produces poor yield. So, if wheat is sown during Mid November, the climate is very appropriate for wheat grown (Thapa et al., 2020). At that time, it can absorb enough solar radiation and harness it for growth and development of grain (Ali, 1999; Anwar et al., 2011; Islam et al., 2015; Rezaei et al., 2012; Wajid et al., 2002). This review paper contains the reasons how morphological and agronomic characteristics of wheat response to difference in sowing date and irrigation supplied. To write this review citation has been done from various national statistical information sites and national and international journals. Major objective of this review is to find how sowing time and irrigation supplied effects in the growth and development parameters of wheat.

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2. OBJECTIVES

The main aim of this study is to find out the effect of sowing and irrigation supply in different time and wheat parameters. This review focuses on the sowing time in which wheat grows the best. The specific objectives are;

1. Find the effect of early, late and timely sowing of wheat on its growth.
2. Determine appropriate time of sowing.
3. Prevent wheat from any stress and pathogens by managing sowing time and irrigation.

3. METHODOLOGY

The source used to prepare this review article is solely secondary sources. Various research articles, journals, online sites and relevant reports were taken as reference for the summarization. Reviews and suggestions from professors are also considered to prepare this review article.

4. RESPONSE OF WHEAT PARAMETERS TO SOWING TIME

Sowing of wheat is generally done in winter season and latest improved photo-insensitive variety are sown in spring season. Winter season wheat has higher yield result in comparison to the spring season wheat. Wheat in Nepal is generally sown at mid-November (15-25). This time is considered appropriate when the climate and temperature is also appropriate for germination of wheat. Sowing date is found to be the major factor causing delay in various wheat parameters like days to heading, days to ear formation, plant height, day to maturity, tiller per square meter, grain yield and biomass. The experiment has shown that highest wheat grain yield (2.00 t ha⁻¹), the highest straw yield (5.22 t ha⁻¹) and the highest biological yield (7.23 t ha⁻¹) were also found on 15 November sowing (Begum & Kumar Sarkar, 2018).

Early sowing cause irregular emergence whereas late sowing cause injury to crop due to which sowing in time is very important (Shah et al., 2006). Research conducted in Bhairahawa wheat sown on 10th November, 25th November and 10th December has higher yield in comparison to that sown in 25th December which was (3729 kg) (NWRP). Wheat crop sown during November results in better yield and good development where delay in time effects in reduction of tiller, seed index, delay head formation effects in biomass and grain yield (Khokhar et al., 2010). Growth of wheat is on time when it is sown on time. Wheat sown very early have poor yield and grain quality. Wheat sown in 15 November and around it can get enough sunlight for their optimum growth. At this time the temperature basically ranges from 15-22 degree Celsius which is good temperature range required for wheat growth. Being, winter season crop wheat requires 10-12 hours of light for its proper growth and development.

To manage all this climatic requirement timely sowing of wheat is very necessary. The wheat plant attains maximum height if irrigation is supplied in all critical stages of its growth. Similarly, irrigation at CRI, tillering, booting, ear formation stages gives higher number of tillers per sq. meter, higher test weight, higher yield per hectare area and highest harvest index. (Rezaei et al., 2012). Better tillering was obtained in sowing of mid-November than in mid-December (Tanveer et al., 2009). Wheat can gain maximum leaf area index (LAI) if sowing time is appropriate which is also an important character. Good anthesis is another response of wheat to the sowing time. Good anthesis is a sign of maximum grain setting and also the positive sign of good climatic and atmospheric condition. Wheat sown at early winter i.e. in November 25 has various good characteristic responses like more infiltration, good moisture and soil holding capacity, less chance of insect infestation, high nutrient holding in soil etc.

As early winter has less rainfall than spring and other time there is less chance of leaching of nitrogen which is quite beneficial for wheat (Richards and Gomez-Macpherson, 1995). Further, delay sowing of wheat in December or very early sowing in December cause delay in grain formation and grain filling. Wheat sown in 25th November is found to mature earlier than those sown late. Harvest index data and biological yield index was found to be higher in wheat sown in 25th November than in 10th of December (Bhatt, 2018). It was found that the wheat which was sown in 25th November grain yield was the highest i.e. 3729 kg per hectare

whereas wheat sown in 10th Nov, 10th Dec and 25th December was found to be 3568, 3729, 3404, 2769 kg per hectare respectively (NWRP, Annual Report, 2017). For Days to heading, the wheat sown in 25th December took the shortest of 70.22 days. Wheat sown in 10th Nov have highest dry matter content. Similarly, wheat sown in 10th Nov has greatest plant height. Similarly, wheat sown in 10th Nov has highest spike length. Similarly, wheat sown in 25th Dec has highest tiller per head. And wheat sown in 10th December has highest thousand grain weight.

5. CHANCE OF DISEASE ATTACK

In Nepal, wheat is found to be very susceptible to Foliar blight complex. More disease that affects wheat cultivation are leaf rust, strip rust, loose smut and powdery Mildew (Timalsina et al., 2019). Such infestation of insect and disease has found to decrease the wheat production by 8-30 percentage. It decreases the gain number and grain filling which leads to low productivity of wheat. These days, new varieties of wheat have been introduced and are cultivated but the bacteria and viruses are gaining resistance resulting wheat to be prone to diseases. The disease progress curve of Bhairahawa for foliar blight is highest (747.53) and lowest (69.14). All these chances of occurrence of disease can be minimized by managing the wheat to sow in time.

6. RESPONSE OF WHEAT PARAMETERS TO IRRIGATION

Irrigation is one of the most important factors for wheat growth and development. Wheat does not prefer the water stagnation but it is necessary for the soil to be moist enough for the growth. It does not need the submerged level of water for its growth but supplementary level of irrigation is very important. Wheat growth occurs in winter season on the month of November to March which is dry period in Nepal. The rainfall occurs very less in this time period. It is very necessary to provide irrigation to wheat on the basis of rainfall occurred. Water should be sprinkled on the field just after sowing. In case of limited supply of water, wheat should be irrigated on its critical stages like Crown Root Initiation Stage, heading stage and grain filling stage. These stages are very sensitive stages where water supply is very essential. In case of lack of irrigation during these stages, the productivity highly decreases and wheat quality is also reduced. Sowing in November 15 can produce good starch content in wheat grains (Farooq et al., 2015).

Irrigation in wheat aids in increasing the cell turgidity which is very essential for carrying out various physiological stages like photosynthesis, respiration, bio-chemical processes in wheat. So, the relationship of irrigation requirement of wheat is complex one as it causes a huge difference in growth processes and yield of wheat. Irrigation supplied at early stages can show good growth of wheat but water uptake by wheat also depends on soil texture and climatic conditions as well. Frequent irrigation provides wheat to prevent from the water stress condition and to attain the good growth. In various hilly regions of Nepal there is limited supply of water as rivers are far from house and irrigation facility is not available. In these areas' wheat yield are found to be very poor and has a huge difference than that of Terai. On the other part, terai being plain and near to water sources irrigation facility is available in terai which makes it favorable for crop production. At the time of mid-November to last (November 15-November 25) time wheat can be stagnation free as there is less chance of rainfall comparing to December. Wheat doesn't prefer stagnation condition so in moist soil its performance is good. So, among various regions of Nepal Terai is considered to be favorable for wheat growth due to the appropriate temperature range and availability of supplementary irrigation in this area.

Water supply to is very important for wheat crop to uptake the nutrients available in soil, to have maximum growth, anthesis, photosynthesis, grain formation, grain filling and almost every other processes. For later growth staged water stress has not cause much significant decrease in wheat productivity (Krida et al., 1996). So, enough moisture should be available in the soil to carry out these activities. As water requirement is not supplied, it directly effects on the anthesis accordingly which ultimately leads to the poor yield of wheat and low grain quality. Without providing

supplementary irrigation it's impossible to produce wheat in Nepal (Nayava et al., n.d.). Therefore, it is seen that main focus should be given to manage the irrigation requirement in wheat and increase its water use efficiency. According to Annual report of NWRP, 2017 wheat in which irrigation was supplied at CRI+FS+MS gave highest yield. Emergence was found highest in treatment in which irrigation was supplied at CRI+FS. Dry matter content, plant height, Thousand Grain weight, total biomass and straw yield was found highest at CRI+FS+MS. (NWRP, 2017) .Note: DH= days to heading, DM= days to maturity, PH= plant height, SL= spike length, TGW=thousand grain weight, HI= harvest index, *= significant 0.01% probability, **= significant 0.05% probability

7. CONCLUSION

Wheat is the most important cereal crop in Nepal. It has been contributing a lot for the economy of our nation. Being a agricultural country farmers depend upon farming and mostly on wheat as it is the important cereal crop. Lack of proper equipment's for modern farming, subsistence type farming still exists which readily effects in the production. Farmers are seeming to be complaining on poor wheat growth and low productivity. This review article is about various parameters that effects wheat production. It shows that appropriate sowing time and access to supplementary irrigation is very important in order to gain good growth and development and to obtain maximum production. This research and review clearly show the importance of water. Since, we have no any wheat stress resistant varieties we need to provide at least 6-8 irrigation to wheat at various stages.

Water supply not only improves growth but also enhance the nutrient uptake capacity, utilization of the minerals and nutrients from soil, helps in biochemical functioning as well. Similarly, this review also shows that timely sowing of wheat automatically increases the chance of production by reducing the chance of delaying in growth and chance of insect infestation. Moreover, sowing in time helps to prevent from bad environmental conditions and climate. All morphological characters like tillering, ear head formation, spike formation, number of spikelet's per head and grain yield is directly related to sowing time. Sowing at appropriate time not only helps in proper growth but also helps to prevents from worst climate, insect attack and injuries Hence, sowing time and irrigation supply are found to be the critical factors for wheat growth hence they should be managed well so wheat could have good growth response and high yield.

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