Impacts of sowing and climatic conditions on wheat yield in Nepal

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Abstract:
Wheat is one of the important cereal crops in Nepal as well as globally. But due to varied climatic and sowing conditions low production has been reported throughout the world including Nepal. Sowing rates are highly correlated to yield and its yield attributing characters. Yield loss has been reported 50-62% under a late sown condition which shows a heavy threat to food security problems. Vijaya is the most recommended varieties under late sown conditions due to its high yield and less threat to late sown conditions. Thus identification and release of varieties suitable under late sown conditions are of the utmost importance. Researches should be accelerated under different agro-ecological zones to study the constraints associated with late sown wheat in Nepal.

Keywords: Harvest index; productive tillers; wheat-cotton belt; spikelets; BL-3060

1.0. Introduction

Wheat ranks the third position in Nepal in terms of area (754243 Ha) and productivity (2.29t ha^{-1}) after rice and maize [1]. In a study they estimated the productivity of wheat to be 2.5 t ha^{-1} but are below the global productivity of 3.41 t ha^{-1} [2,3]. Globally, wheat, maize, and rice are major field crops that cover 40% of the global cropland of 1.4 billion Hectare [3]. The global wheat production for the year (2013) was 716 million tons, which was increased by 18.35% in comparison to the year 2007 [4]. Wheat in Nepal is mainly grown as winter season crop after harvesting of rice in terai and maize in low hills and high hills.

Among various factors responsible for low yield of the wheat crop, sowing time and varietal selection are of primary importance. A proper planting date is a primary factor for crop production of wheat. Wheat in Nepal is generally sown from November to late December, and it is harvested in March- April is reported by [5]**.** Different planting dates affect seed development, kernel quality and yield of wheat. Delay planting affects the crop performance in the field and ultimately produce low yield. Delay in planting normally reduces individual plant growth and tiller production [6]. Wheat is very sensitive to sowing dates and a decline in yield has been observed under delay planting. Delay sowing not only reduces yield but also the efficiency of the inputs applied. Thus sowing date is one of the key factors in yield characteristics of wheat and sowing in the appropriate date reduces the chance of yield reduction. Thus a study of late sown wheat and its effect on yield and yield attributes should be extended to different research stations of Nepal. There is still a research gap between researchers and late planting wheat in Nepal.

Late planting of wheat is one of the serious threats to Nepalese agriculture due to highly reduced yield and poor grain quality [7]. This review paper focuses on the causes of the late planting of wheat and the effects encountered in the differing sowing dates. Various literature reviews and past research related to sowing dates in Nepal and on a global level have been cited, to sum up, the possible effects. Also, some of the good performing varieties have been cited to highlight their performance in the late sown condition in Nepalese terrain. The main objective of this paper is to highlight the major causes and effects associated with the late planting of wheat in Nepal and to identify the promising and good performing varieties in the late sown condition in the Nepalese condition.

2.0. Methodology

Secondary information related to the late planting of wheat was collected using different national and international open access journals. Furthermore, ministry articles, conference papers, bulletins, newspaper articles, websites were also used to collect the information regarding the causes and effects observed in the late planting of wheat.

3.0. Findings

3.1. Causes of late sown wheat in Nepal

Delay in sowing of wheat in Nepal is strictly observed in rice-wheat and cotton- wheat cropping patterns. In a study they reported that 84% of the wheat is sown after harvesting of rice in Terai and Siwalik hill plains of Nepal [8]. Delay planting of wheat is a serious threat in conventional practiced rice-wheat areas of South Asia including Nepal [9]. One of the serious problems for the delay in sowing of wheat is due to farmers selecting indigenous Photosensitive varieties. Late maturing of basmati Varieties in rice-wheat cropping pattern resulted in a delay in the planting of wheat. Cotton picking is an important event in the wheat-cotton belt. Harvesting of cotton is done from mid of December to early January. However, a timely sown of wheat is done during October. However, the cotton belt delayed the wheat production to mid of January as land preparation is an important event in the sowing of wheat. Late sowing of wheat is also seen due to the indeterminate maturing of cotton balls. High weed infestation is also one of the causes of delayed planting. Besides these reported that the long turnaround time between the rice harvest and wheat planting, which can be caused by many factors, including excessive soil moisture problems, lack of animal or mechanical power for plowing and the priority farmers place on threshing and handling the rice crop before preparing land for wheat [10].

3.2. Effect of late sown wheat in Nepal

3.2.1. Seed emergence (per m^2) or germination percentage

Germination of seed is comparatively lower in late sown compared to timely sown wheat [11]. A group researchers reported that emergence (per m^2) declined as planting was delayed from November 1st to 16th of January [6]. Higher seed rate in late sown wheat is recommended to maintain the optimum plant population. Seed rate of wheat was increased from 62kg to 99kg in cultivar Bakhtawar-92 in Pakistan [12]. Similarly, a higher number of tillers under the higher plant population due to a rise in seed rate was also reported [13].

3.2.2. Tillers per plant

Number of tillers per plant is found to be associated with yield attributes of wheat. However, productive tillers and unproductive tillers are reported in wheat. The highest number of a productive and low number of unproductive tiller was reported in timely sown wheat [6,14].

3.2.3. Days to heading and sterility %

Late sown wheat reaches to heading earlier as compared to a timely sown. In a study they reported that time from sowing to anthesis was decreased by twenty days on December 30 sown crop as compared to November 10. It might be due to relatively higher temperatures during the anthesis of the late

sown crop [11]. The production of non-functional pollen leads to an increase in sterility which might be due to a higher temperature on the environment. Some study reported that sterility percent was higher in late sown (42.65%) in the Chitwan condition [15].

3.2.4. Number of grains (per spike)

A group researhcers reported that delay in sowing causes a decline in number of grains (per spike). Similar type of observation was also made for low grains per spike in late sown condition [16,17]. Temperature plays a crucial role in prolonging the ear formation period and also reported that the number of grains per spike is determined earlier before flowering [18]. Due to short growing period, less production of photosynthates resulted in the low number of grains per spike in late sown or delay in sowing.

3.2.5. Grain quality and 1000 grain weight

The quality of grains refers to the bold and plump kernels. Higher percentage of bold and plump seeds are obtained from timely sown wheat. Shriveled and sunken seeds are highly recorded in late sown wheat which is unfit for seed production and also, low germination percentage is recorded [14]. Late sown wheat fetches low market prices due to poor quality of grains [19]. A report that thousand grain weight declined as an increase in plant population and also due to differences in sowing dates [17]. Similar type of observation was also made under Chitwan condition between 14th of November to 14th of December [16]. Lower thousand grain weight in late sown wheat is due to low grain filling period and hot air wind and high temperature prevailing in the environment [20].

3.2.6. Harvest index and yield

Harvest index (HI) is taken as a ratio of grain yield with biological yield. Biological yield is taken as the sum of grain yield and straw yield or total biomass [21].

Mathematically, expressed as HI= (grain yield ×100)/ (grain yield +straw yield).

The harvest index was low for late-planted conditions (14th December) than for timely sown (14th of November) [16]. Similar type of findings was reported by [6]and supported by [22]. Grain yield of wheat is a result of the combined effect of various yield attributing components. The drastic reduction in wheat is observed in late sown conditions. Different authors have reported a significant difference in yield in delay sown wheat with respect to timely sown wheat. A reduction in straw and grain yield in late sown condition; 4.62% lower yield than that of the timely sown crop was reported [16,19]. [11] reported that 62.25% of yield was higher in October than that of sown in January. The number of spikes or mean seed weight in delay planting could not compensate for the increases in the yield of timely sowing due to high temperature at the anthesis stage and reduced season length [11]. A report a varied yield under different agronomic management in different sowing dates as shown in figure 1 [9].

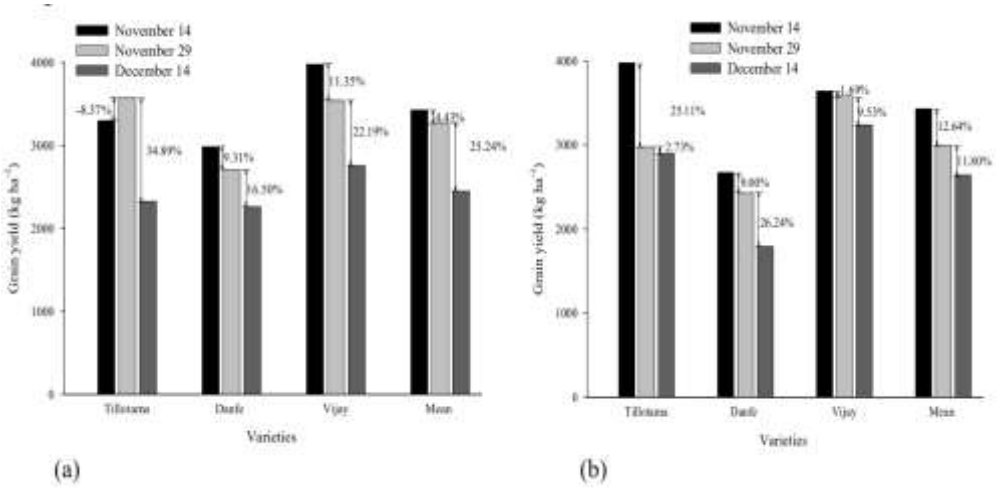

Figure 1: Effect of yield in wheat at different sowing dates under different agronomic management a. conservational agriculture b. conventional agriculture

Table 1: Responses of some of the promising cultivars (for late sown conditions) reported in Nepal in different sowing dates

S.N.	Varieties	Sowing conditions	Yield	Place of research	References
1.	BL-3060 (Vijay)	Early and late sown condition	3458 Kg/ha	Bhairahawa; Chitwan	[16], [23]
2.	NL-3063	EARLY AND LATE SOWN CONDITION	7% higher than current popular variety	Bhairahawa	[23]
3.	NL-1177	EARLY AND LATE SOWN CONDITION	2993kg/ha	RARS, Tarahara	[24]
4.	BL-3555	EARLY AND LATE SOWN CONDITION	2764 Kg/ha	RARS, Tarahara	[24]
5.	NL-539	Early and late sown conditions	2180 Kg/ha	N/A	[25]
6.	UP-2121, UP-262, RR-21, BL-1135	Sown upto 10th December	1710-1970 Kg/ha	Chitwan	[26], [27]

N/A= not available; kg= kilogram; ha=hectare

4.0. Conclusion and Recommendations

Wheat is one of the important cereal crops after rice and maize in Nepal. It has a significant contribution to the Nepalese economy and yet is more potential to aid in the Nepalese economy. Good agronomic practices and planting in effective dates are important to get potential yield. As wheat, rice and cotton is also tantamount in importance and has also a potential role in the Nepalese economy. But proper management of crops is necessary, and selection of early

maturing cotton and rice helps to timely sowing of wheat. Due to differences in sowing dates, yield and yield attributing characters of crops are highly affected. Yield reduction up to 62% was reported in January sown crop. Thus, researches regarding late sown wheat are to be accelerated as higher yield loss has been reported by farmers and growing as major constraints in cereal-based cropping pattern. Overcoming the causes associated with the delay in planting should be emphasized and efficient programs should be conducted at farmers' level. Thus, this paper highlights the research status of wheat in relation to sowing dates and points for the yield loss as a major constraint. However, varieties like BL-3060 (Vijay), NL-3063, NL-1177, BL-3555, NL-539, UP-2121, UP-262, RR-21, BL-1135 are found to be promising one in the late sown condition in Nepal. Thus the selection of promising varieties should be recommended under late planting conditions at farmers level through different approaches as they are unaware of this.

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