Assessing the Impact of Different Sowing Times on Growth and Yield Performance of Ispaghol (*Plantago ovata*) Cultivated in Arid Environment of Cholistan Desert of Bahawalpur

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Abstract- Isabgol (*Plantago ovata*) is a valuable medicinal crop. The study evaluated the growth and yield performance of Ispaghol (*Plantago ovata*) in the dry zone of Bahawalpur under various planting dates in order to determine the ideal sowing time. Using germplasm from five accessions, five different sowing timings (T1: October 15th, T2: November 1st, T3: November 15th, T4: December 1st, and T5: December 15th) were evaluated. The experiment used a randomized complete block design with three replications and it was carried out throughout the 2019–2021 rabi season. At essential growth phases, a number of agronomic characteristics were observed. According to the results, The maximum grain yield (1653 kg/ha) and 1000 grain weight (4.16 g) were obtained from sowing on November 1st (T2) along with the highest harvest index (56.3%). On the other hand, out of all the accessions, the planting date of December 15th (T5) yielded the lowest grain yield (918 kg/ha). T2 outperformed the other sowing periods in terms of growth performance across a range of characteristics; T1, T3, and T4 came next. T5 displayed the fewest granules per plant. In general, the best date to seed ispaghol in the research region was found to be November 1. The purpose of this study was to determine the optimal sowing time for improving ispaghol (Plantago ovata) growth and yield performance.

Index Terms- Relative humidity, Growth stages, Floral initiation, Genetic parameters, Subsequent

I. INTRODUCTION

Isbagol is the colloquial name for *Plantago ovata*, Family Plantaginaceae. (Bahadar, K., *et al* 2018). The annual stemless medicinal plant known as isabgol (*Plantago ovata*) has long been used as a medicine in South Asia and throughout the world for its medicinal properties. Isabgol also known as psyllium husk is a dietary fiber that helps to increase stool and promote laxation. It is one of the most commonly used home remedies for constipation. Isabgol is good for weight loss as it gives a feeling of fullness and helps prevent overeating. The tissues from isabgol are regarded as the most significant in the world of vegetation. (Kumar, S., 2023). The husk, or seed coat has therapeutic qualities and is used for treating a variety of conditions, including constipation and inflammation of the digestive tract. Among other things, the food industry uses it to manufacture biscuits, candies and ice cream. Blond psyllium (*Plantago ovata*), often known as "Isabgol," is one of the most important medicinal plants. It is widely grown in India to make both traditional and contemporary drugs. (Pradeep P., 2014), Sharma NK (2013). Annual plants known as isabgol (*Plantago ovata*) are frequently utilized in both conventional and industrial pharmacology. They are native to arid and semi-arid regions. It is stated that isabgol's grains and husks are frequently utilized as laxatives in medicine. (Patel, B.S., 1996). Isabgol's usage in high-fiber breakfast cereals and claims that it can effectively lower cholesterol have generated the most interest in the supplement. Isabgol is a small, delicate plant that is mono-cultured under unfavourable conditions which results in yield and quality degradation from pests. (Asgharipour, M., & Rafiei, M. 2010).

Therefore, there are many advantages to Isabgol's seeds and husk, particularly for intestinal irritations, diarrhea and the digestive system. Decoction is beneficial for cough and chronic diarrhea. (Roumani A, 2022 & Anavkar A, 2022). Native to the Mediterranean, Isabgol can be found in the vicinity of India, Pakistan and Iran. (Sharma, 2004). The ability of isabgol seed husk to absorb and hold onto water explains why it is useful in treating diarrhea. It is a diuretic that relieves gonorrhea, hemorrhoids, arthritis and problems related to the kidneys and bladder. The popular name for an annual plant in the 200-species, Plantago genus is psyllium, and it is found in its seeds. The *Plantago ovata* Forsk. species is known as the most significant and well-known, having a vast range of applications. It is also known by the name Isabgol, which in Indian means "horse ear" and reflects the form of the seed. (Franco, E. A. N., 2020). In the Ayurvedic medical system of traditional India, psyllium is often used to prevent skin irritations, hemorrhoids, constipation and diarrhea. By mechanically milling and grinding the outer coating of the seed, a substance known as mucilage is obtained from the psyllium (*Plantago ovata*) seed coat. A class of transparent, translucent gelling substances originating from plants is known as mucus. (Verma & Mogra 2013). Because psyllium mucilage is regarded as a rich source of both soluble and insoluble fiber and is known to be a naturally occurring polysaccharide that forms gels, it has a long history of use as a nutritional supplement. (Singh, 2007). While late sowing reduces the overall

development period and raises the possibility of seed shattering as a result of pre-monsoon showers as the seed ages, early sowing encourages higher vegetative growth. November's second and third weeks are the best times to plant. There is a notable yield loss if seeding is postponed past the first two weeks of December.

Material and methods

The experiment was carried out at latitude 29.22o, longitude 71.38o, and elevation 367 feet at the Pakistan Agricultural Research Council's Arid Zone Research Institute in Bahawalpur. The field recorded 6 to 40.7oC of temperature, 76.5 to 80.4% of relative humidity, and 6 to 13 mm of rainfall. The germplasm used in the study was laid down in RCBD with a total of three replications during the 2019–21 Rabi season and it came from five different accessions (Accession No. 21213, 21474, 20617, 21260, and 21988) that were procured via IABGR, NARC Islamabad, Pakistan.

Sowing Time

Five distinct sowing times were selected as treatments to assess their impact on Ispaghol growth and yield. Different sowing times are:

T1: 15th October
T2: 1st November
T3: 15th November
T4: 1st December
T5: 15th December

Parameters:

Data on various agronomic traits and growth parameters was systematically collected at crucial growth stages. The data was recorded for eight genetic parameters viz; (DFI), (DF), (PH), (NTPP), (NSPP), (SPL), (DM) and (SYPP). These parameters included:

Plant stand: The count of healthy plants per square meter.
Days to flower initiation (DFI): The duration from sowing to the emergence of the first flower.
Days to 50% flowering (DF): The time it took for half of the plants to initiate flowering.
Number of plants/m^2 (NP): The plant density per square meter.
Plant height (cm) (PH): The vertical length of the plants.
Number of tillers/plant (NTPP): The secondary stems or branches emerging from each plant.
Number of spikes/plant (NSPP): The count of flowering spikes on individual plants.
Spike length (cm) (SPL): The measurement of the length of the flowering spike.
100-grain weight (g): The weight of 100 seeds, providing insights into seed size.
Days to maturity (DM): The duration required for the crop to reach full maturity.
Seed yield (kg/ha): The total seed output per hectare of land.

Sr. No	Abbreviations used	Name of characters
1	DFI	Days to floral initiation
2	DF	Days to 50% flowering
3	PH	Plant height
4	NTPP	Number of tillers per plant
5	NSPP	Number of tillers per plant
6	SPL	Spike length
7	DM	Days to maturity
8	NP	Number of plants
9	ANOVA	Analysis of variance

Table 1: plant symbols and characteristics of plants.

Results

The purpose of the trial, which was carried out at the experimental area of PARC AZRI, Bahawalpur, during the rabi season 2020–21, was to determine the ideal time to plant and to create and provide technology to farmers for the growing of ispaghol with the subsequent treatment. T1: October 15th; T2: November 1st; T3: November 15th; T4: December 1st; T5: December 15th. At different critical growth stages, such as plant stand, days to flower initiation, days to 50% flowering, number of plants/m2, plant height (cm), number of tillers/plant, number of spikes/plant, spike length (cm), 100 grain weight (g), days to maturity, and seed yield kg/ha, scientific data on various agronomic traits for various growth and yield parameters were gathered. i.e. Plant stand, days to flower initiation, days to 50% flowering, number of plants/m2 , plant height (cm), number of tillers/ plants, number of spikes/plant, spike length (cm), 100 grain weight (g) , days to maturity and seed yield kg/ ha. The findings indicated that November 1st was the ideal date to sow ispaghol in this area. T2 (1st November) produced the most grain per plant, whereas T5 (15th December) produced the least amount of grain per plant. Treatment T2 produced the highest grain yield (1653 kg/ha), the highest 1000 grain weight (g) (4.16 g), and the highest harvest index (%) of 56.3%. For all five Plantago varieties (Accession No. 21213, 21474, 20617, 21260, and 21988), treatment T5 produced the lowest grain yield (918 kg/ha). The highest growth performance was observed across all parameters with T2 (1st November), followed by T1 (15 October), T3 (15 November), and T4 (1st December). T5 (15th December) produced the lowest number of grains per plant.

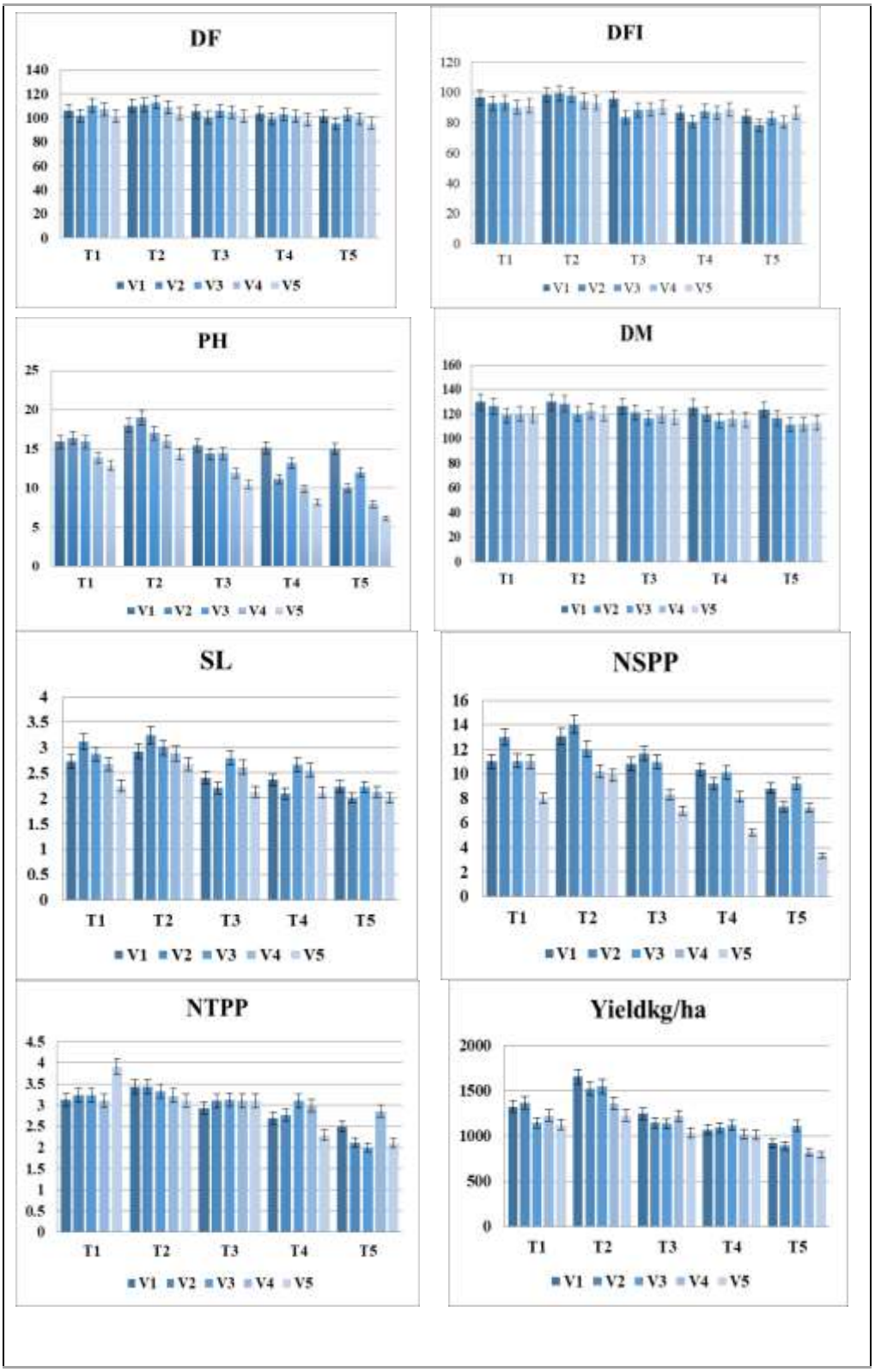

Table: 2 shows the characteristics of Ispaghol (Plantago ovata) grown using various sowing methods.

confident about their work and takes a jump to start the paper writing.

B. Use of Simulation software

There are numbers of software available which can mimic the process involved in your research work and can produce the possible result. One of such type of software is Matlab. You can readily find Mfiles related to your research work on internet or in some cases these can require few modifications. Once these Mfiles are uploaded in software, you can get the simulated results of your paper and it easies the process of paper writing.

As by adopting the above practices all major constructs of a research paper can be written and together compiled to form a completeresearch ready for Peer review.

Correlation

The initial objective of correlation analysis was to understand the ways in which various variables affect one another and yield. The eight different variables showed this correlation.

	DFI	***DF***	***NTPP***	***NSPP***	***SL***	***PH***	***DM***	***SYPP***
DFI	1							
DF	0.887	1						
NTPP	0.7516	0.708822	1					
NSPP	0.781	0.684732	0.676774	1				
SL	0.868	0.812042	0.79971	0.76	1			
PH	0.8445	0.768623	0.586338	0.89	0.74	1		
DM	0.676	0.422797	0.476073	0.67	0.4661	0.78	1	
SYPP	0.885	0.793721	0.695133	0.83	0.804	0.80	0.644	1

Table: 3 correlation

While DFI is only moderately strongly connected with NSPP (0.781) and DM (0.677), it is substantial and highly positively correlated with DF (0.887), NTPP (0.752), SL (0.869), PH (0.845), and SYPP (0.886). DF has a moderate correlation with DM (0.423) and NSPP (0.685), and a positive correlation with DFI (0.887), NTPP (0.709), SL (0.812), PH (0.769), and SYPP (0.794). While NTPP has a moderate correlation with DM (0.476), it is very significant and positively correlated with DFI (0.752), DF (0.709), NSPP (0.677), SL (0.800), PH (0.586), and SYPP (0.695). NSPP has strong positive correlation with plant height (PH) and seed yield per plant (SYPP) while it is moderately positively correlated spike length (SL) and days to maturity (DM). SL has strong positive correlation with seed yield per plant (SYPP 0.804666) and plant height (PH). Plant height has strong positive correlation with days to maturity (DM) and seed yield per plant (SYPP) while DM has moderate positive correlation with seed yield per plant (SYPP). SYPP has a strong positive correlation with DFI (0.8857) and DF (0.7937) whereas it has a moderate positive correlation with SL (0.8047).

Conclusion

The purpose of this study was to determine the optimal sowing time for improving ispaghol (Plantago ovata) growth and yield performance. There were five treatments of different sowing time (T1: October 15th; T2: November 1st; T3: November 15th; T4: December 1st; T5: December 15th). This study concluded that T2 (1st November) produced the highest grain yield (1653 kg/ha), the highest 1000 grain weight (g) (4.16 g), and the highest harvest index (%) of 56.3%. For all five Plantago varieties (Accession No. 21213, 21474, 20617, 21260 and 21988). The highest growth performance was observed across all parameters with T2 (1st November), followed by T1 (15 October), T3 (15 November), and T4 (1st December). T5 (15th December) produced the lowest number of grains per plant. In terms of correlation, there is a significant relationship between DFI, DF and SL, PH and SYPP and in terms of seed yield, SYPP has a strong positive correlation with DFI (0.8857) and DF (0.7937) whereas it has a moderate positive correlation with SL (0.8047).

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