

# EFFECT OF IRRIGATION REGIMES ON GROWTH AND YIELD OF WHEAT VARIETY BENAZIR

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**ABSTRACT:** The field experiment was conducted during rabi season 2014-15 at Wheat Research Institute Sakrand, Sindh (WRI) on newly introduced Benazir-2013 wheat variety to evaluate the effect of irrigation regimes for growth and yield performance under district Shaheed Benazir Abad agro-climatic conditions. Five irrigation levels viz,  $L_1=02$  irrigations @ crown root initiation & tillering phase,  $L_2=03$  irrigations @ crown root initiation[tillering & jointing phase,  $L_3=04$  irrigations @ crown root initiation[tillering[ jointing & booting phase,  $L_4=05$  irrigations @ crown root initiation [tillering[jointing [booting & grain development phase and  $L_5=06$  irrigations @ crown root initiation[tillering[jointing[booting[flowering & grain development stage were applied in randomized complete block design (RCBD). The significant ( $p<0.05$ ) results were achieved. Maximum plant height 88 cm, number of tillers 400.20  $m^2$ , spike length 11.95 cm, 1000-grain weight 57.1 g, grain yield 6.0  $t ha^{-1}$  and harvest index 42.70% were recorded in  $L_5$ , followed by  $L_4$  with standard 05 irrigations produced 85 cm plant height, 11.3 cm spike length, 390.17 tillers  $m^2$ , 53.5 g as 1000-grain weight, 5.8  $t ha^{-1}$  grain yield and 40.7 harvest index. While, lowest all growth and yield traits measured in  $L_1$ ,  $L_2$  and  $L_3$ . Figures demonstrating that there is no significant different between  $L_4$  and  $L_5$  treatments in term of all vegetative and reproductive constituents, Hence, It is reasoned that the five irrigations are necessary for maximum crop yield in district Shaheed Benazir Abad agronomical zone and lack of irrigation adversely affected growth and yield of Benazir wheat variety. Therefore, suggestion is given to the growers that optimum frequencies of irrigation must be applied to new Benazir wheat variety.

**Key words:** Wheat, Irrigation, Benazir, Yield, Climate

## INTRODUCTION

Wheat is a major crop of Pakistan known as crop of irrigated areas, since its yield is directly associated to assured supply of irrigation, deficiency of irrigation causes yield loss, therefore proper irrigation is essential as a requirement of the crop. Too much water or too low water limits the plant growth. Thus, adversely affect crop yield. Extra moisture in field condition during critical growth period can be harmful for the crop in several ways such as reduces the yield, invites to pest, cause diseases and deteriorate the quality [1] which cannot provide premium price due to low market value. Rahim and his team reported that irrigation maximized wheat yield in Pakistan. Its use must be adequate [2]. Applying of irrigation at critical growth periods significantly produced higher grain yield [3]. Deficiency of irrigation water is a notable problem that minimize crop yield around the world [4]. Water is a fundamental need of plants. Crop plant produces the greatest yield in context with that plant cultivated without good irrigation [5]. Moreover, proper irrigated plants during entire growth period has rapid grain filling through better development process and gave good grain weight [6], stress at all critical growth phases resulted minimal yield [7] by negative affect on vegetative and reproductive components. Water insufficiently restricts plant growth (physiological and biochemical) functions, literally result in low grain yield [8]. Yield responses of wheat reported as increased 94% of tillers of irrigated plants produced ears, compared to 79% of the stressed plants and grain yield was reduced to 65% in the stressed plant in contrast of irrigated plant [9]. Ghazal and his co-scientist showed that sufficient frequencies of irrigation are required to obtain economic yield, but four irrigations also provide the maximum number of productive tillers at 330.33  $m^2$  followed by  $L_3$ , where three irrigations were applied [10]. While, Mishra's team investigated on irrigation levels and they recommended five irrigation for wheat at crown root initiation, tillering, jointing, flowering and grain development [11]. From yield point of view the irrigation deficiency at a late stage of the crop may also become additionally limiting

factor [12]. In water scarcity situation, it is recommended that water must be applied to sensitive growth phase which can result in maximum grain yield, biological yield; shoot dry weight and number of grains. It was noted that water stress at booting stage losses in yield [13] and minimum effect was observed at grain development stage [14]. Two irrigations, one at crown root initiation and second irrigation at flowering is proved superior yield performance of wheat [15]. Supply of irrigation is most necessary at anthesis, grain formation and tillering stage because among these stages the anthesis stage is a fertilization stage and in this stage unavailability of water causes reduced number of per spike which result in poor yield of wheat crop [16]. Sufficient irrigation at all critical growth stages of wheat including crown root initiation, tillering, jointing, flowering, booting and grain development stage showed a good yield [17]. Keeping in the points of view, present study was initiated to evaluate the effect of various irrigation levels on growth and yield performance of new Benazir wheat variety in district Shaheed Benazir Abad agro-climatic conditions.

## MATERIALS AND METHODS

This field experiment was conducted at the experimental area of wheat research institute Sakrand, district Shaheed Benazir Abad, Sindh during rabi season 2014-15. The layout were randomized complete block design with three replication and five irrigation levels viz,  $L_1$ : Two irrigations (crown root initiation & tillering phase),  $L_2$ : Three irrigations (crown root initiation, tillering & jointing phase),  $L_3$ : Four irrigations (crown root initiation, tillering, jointing & booting phase),  $L_4$ : five irrigations (crown root initiation, tillering, jointing, booting & grain development phase) and  $L_5$ : six irrigations (crown root initiation, tillering, jointing, boot, flowering and grain development phase). The recommended seed rate 137  $kg ha^{-1}$  (55  $kg/ac$ ) was with single row hand drill in 20-November to insure proper number of seedling per hectare and nitrogen at the dose of 150  $kg ha^{-1}$  and phosphorus 100  $kg ha^{-1}$  were applied. During seedbed preparation, a full dose of phosphorus+half rate of nitrogen was applied in soil and

weeds were controlled by common methods of area including hand pulling throughout the growth period of crop and recommended chemical 333.45 gms ha<sup>-1</sup> dose of Atlantis 36WG weedicide product of Bayer Crop Science were applied against weeds like Jhill (*Chenopodium album* L.), Singh (*Melilotus alba* Des.), Bilibooti (*Anagallis arvensis* L.), Naro (*Convolvulus arvensis* L.), Basri (*Asphodelus*

*tenuifolius* Cav.), Jangli Palak (*Rumex dentatus* L.), Jangli Jai (*Anena fatua* L.) and Dhanak (*Phalaris minor* L.) etc at 45 days after sowing. The data were taken in grain yield (Kg ha<sup>-1</sup>), 1000-grain weight (g), harvest index (%), plant height (cm), spike length (m<sup>2</sup>) and number of tillers (m<sup>2</sup>) with standard procedure. Collected data were analyzed at statistix 8.1 software package of computer.

**Table 01: Soil and water analysis of wheat research institute at Sakrand**

Depth (cms)	Salinity	Ph	OM%	N%	P <sub>2</sub> O <sub>5</sub> (ppm)	K <sub>2</sub> O (ppm)	Texture
0-15	0.064	8-9	1.062	0.0531	8.91	294	Silty Clay Loam
15-30	0.064	8-15	0.614	0.0315	5.81	210	Silty Clay Loam
Irrigation Quality							
Location/Source		EC	Ph			T.S.S (ppm)	
Canal Water		0.22	7.8			140	



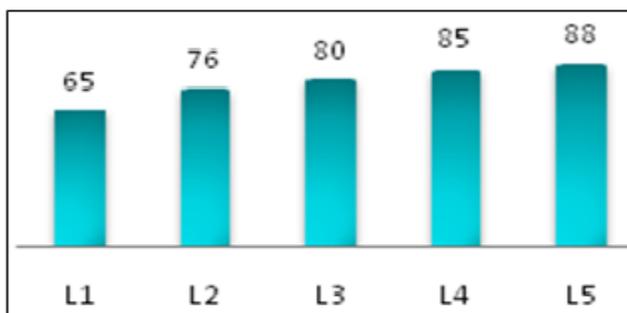
**Fig. 01: Map showing experimental location district Shaheed Benazirabad (SBA), Sindh, Pakistan**

## RESULTS AND DISCUSSION

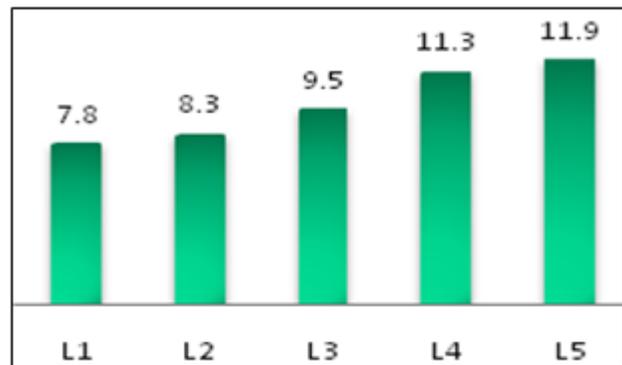
Result showed a significant effect of irrigation on wheat crop. According to readings, maximum plant height of 88 cm, spike length 11.95, number of tillers 400.20 m<sup>2</sup>, 1000-grain weight 57.1 g, grain yield 6.0 t ha<sup>-1</sup> and harvest index 42.70% were recorded in treatment L<sub>5</sub> which received six irrigations at all growth stages includes crown root initiation, tillering, jointing, boot, flowering, grain development phase, followed by five irrigations (L<sub>4</sub>) were applied at crown root initiation, tillering, jointing, booting & grain development stages resulted second number most 85 cm plant height, 11.3 cm spike length, 390.17 tillers m<sup>2</sup>, 53.5 g as 1000-grain weight, 5.8 t ha<sup>-1</sup> grain yield and 40.7 harvest index. And lowest values for all growth and yield parameters were observed in L<sub>1</sub>, L<sub>2</sub> and L<sub>3</sub>, such as reduced height of plant 65, 76 and 80 cm, length of spikile 7.8, 8.3, 9.5 cm, no of tillers m<sup>2</sup> 230.15,

280.60, 320.40, 380.17, 1000- grain weight 22.5, 30.2, 37.6 g, grain yield 2.1, 2.5, 3.4 t ha<sup>-1</sup> and harvest index 29.36, 32.10, 36.55%, where 02 irrigations at crown root initiation, tillering phase, 03 irrigations at crown root initiation, tillering, jointing phase and 04 irrigations at crown root initiation, tillering, jointing, boot phase were applied respectively. In our experimental trial the wheat crop yield is increased toward increased irrigation regimes because of irrigation is especially vital for maximum crop yield in areas where higher temperature is typically more noteworthy consistently. Shaheed Benazir Abad (NawabShah) is comprised in the territory of 4239 Sq. km in the Sindh province of Pakistan has hot climatic conditions. The most astounding recorded temperature during the summer season was 52 °C and least noted temperature in winter as 4 °C or 32 °F in the weather history. The winter season begins from

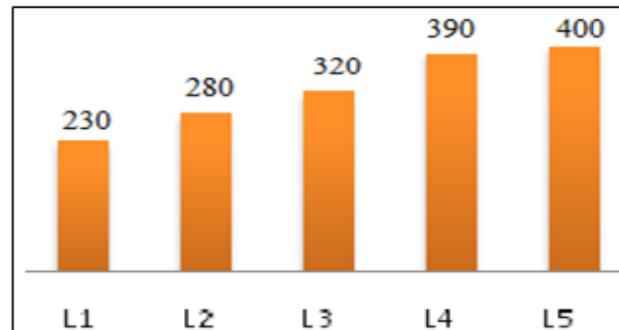
November and it continues till the end of February, hence Shaheed Benazir Abad is topmost high temperature district in Pakistan. Only 1 mm precipitation occurs during January. While, July month is a period of extreme rainfall which could not be useful for the wheat crop. Yearly normal rainfall is around 143 mm [18]. Generally, in higher temperature ranges, the water becomes secret of maximum yield. Last growth stages of wheat appear into the time of rising of temperature degree and those stages are reproductive and has direct relation with yield. In this way, water requirement of crop increases and optimum irrigation necessary. So, irrigation levels must be sufficient which ought to meet the crop needs. Water lack lessen yield by bringing on dry spell in the root zone of plant. In any case, it is observed from the scientific investigation that Benazir wheat has strong growth traits which gave an average yield at five and four irrigations. But appropriate irrigation to the crop is only way to improve yield much as possible by reducing of stress losses. New Benazir wheat is a long duration variety thus requires more water to maturity. Moreover, scientifically, from total uptake water of plant about 95% is losses through transpiration, when irrigation available then better transpiration starts, it has cooling impact in a plant that permits great plant's physiological and biochemical capabilities. In tropical regions like NawabShah, the number of irrigations are basic yield limiting factors if are limited. Also, our findings are supported by Maqsood and his group [19] who found that increasing irrigation gives better growth. More, irrigation at critical growth stage encouraged root development [20]. Irrigation levels significantly affected spike length, insufficiency reduced spike  $m^2$  and harvest index [21; 22]. Adequate water is most important throughout all growth stages that gave greatest statistical values for growth and yield components over no irrigation situation. It increased 20.58% number of tillers, 26.07% grains spike<sup>-1</sup>, 42.72% grain yield, 16.71% HI and 3.31% grain protein [23]. Such effect of irrigation on yield also investigated by Khakwani and his co-researchers [24]. Akram [25] conducted an experiment on water stress with growth stages of wheat, observed that yield constituents are associated with water contents. Findings of Ram's scientists team [26] additionally supports to our outcomes, they said that more irrigation gives more yield. Along these lines, in the object of the maximum wheat yield at district Shaheed Benazir Abad climate, the standard five irrigations must be applied.



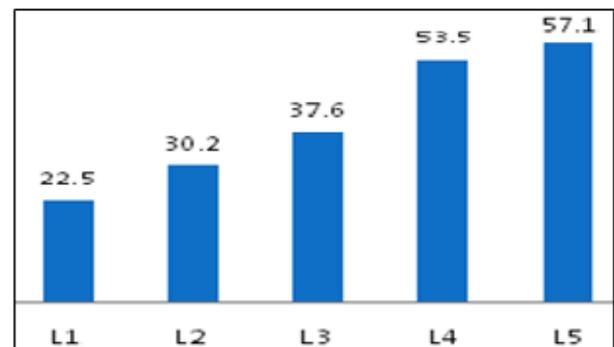
**Fig. 02: Plant height (cm) of Benazir wheat variety significantly influenced by various irrigation levels**



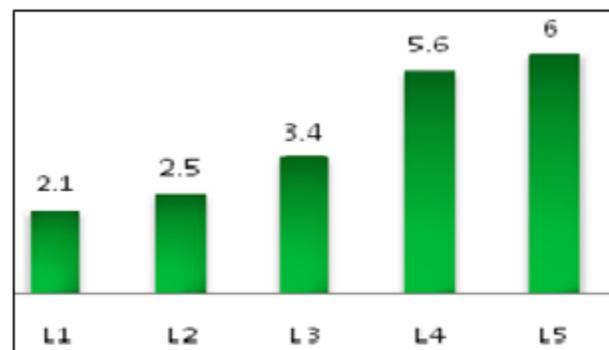
**Fig. 03: Spike length (cm) of Benazir wheat variety significantly influenced by various irrigation levels**



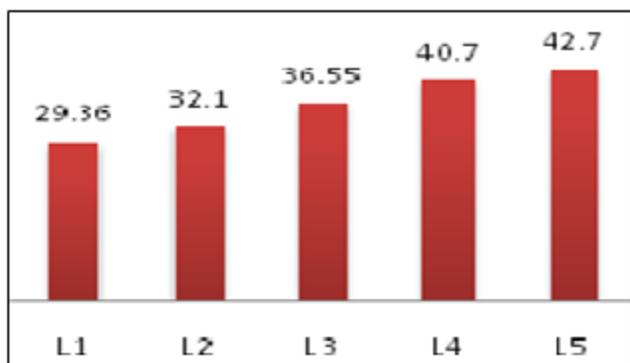
**Fig. 04: No. of tillers (m<sup>2</sup>) of Benazir wheat variety significantly influenced by various irrigation levels**



**Fig. 05: 1000-grain weight (g) of Benazir wheat variety significantly influenced by various irrigation levels**



**Fig. 06: Grain yield (tons ha<sup>-1</sup>) of Benazir wheat variety significantly influenced by various irrigation levels**



**Fig. 07: Harvest index (%) of Benazir wheat variety significantly influenced by various irrigation levels**



**Fig. 08. Great uniformity and shining appearance of Benazir-2013 wheat variety at maturity stage**

## CONCLUSION

It was concluded that five irrigations at various growth stages like crown root, tillering, booting, anthesis and grain development are necessary for Benazir wheat variety to obtain maximum yield ( $5.6 \text{ t ha}^{-1}$ ) at district Sheed Benazir Abad agro-climatic conditions. However, Benazir wheat variety produced highest yield at  $6.0 \text{ t ha}^{-1}$  at six irrigation regimes and possibility more potential yield can be achieved at increased irrigation levels, since Benazir is a long duration variety, but it could not be recommended due to irrigation availability issues in Sindh.

## ACKNOWLEDGMENT

The authors are highly thankful to the coauthor of this research paper Dr. Karim Bux Laghari, director, Wheat Research Institute (WRI) Sakrand, Sindh for kind cooperation, support and provision of all research facilities to accomplish the work during internship program.

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