**Influence of Irrigation Schedules and Cow Urine Spray on Density and Dry Biomass of *Cynodon dactylon***

**ABSTRACT**

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| The study aimed to assess the combined effect of irrigation scheduling and cow urine application on weed dynamics, focusing on the density and dry biomass of Cynodon dactylon in wheat during the rabi seasons of 2019–20 and 2020–21 at the research farm of the Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. A split-plot design was used with three main plots representing different irrigation schedules and seven subplots representing cow urine sprays at various growth stages of wheat and replicated thrice. Each treatment received a total of 4000 liters of cow urine per hectare, applied in equal doses at designated stages. The results revealed that neither irrigation schedules nor cow urine sprays significantly affected Cynodon dactylon density or dry biomass across different growth stages during both years of the study. At 90 DAS, the minimum density was recorded under I1 in the first year and I2 in the second year, while the maximum occurred under I1 in both years. The lowest dry biomass was observed under I3 in the first year and I2 in the second year, whereas the highest dry biomass occurred under I1 across both years. For cow urine treatments, the minimum Cynodon dactylon density was found in C6 during the first year and C2 during the second year, while the maximum density was recorded under C7 in both years. The study concluded that irrigation schedules and cow urine sprays at different wheat growth stages had no significant impact on the density or dry biomass of Cynodon dactylon in either year. |

**Key Words:** Irrigation Schedules, Cow Urine, Dry, Biomass, Weed, Density

# 1. Introduction

Wheat is one of the most important cereals in the world. In India, wheat is the second most important staple food after rice, consumed by nearly 65% of the Indian population, and ranks first in dietary shares in northern India represented by the Gangetic plains. Presently, wheat accounts for 96.64 MT. The productivity of wheat depends upon several factors such as crop establishment techniques, weed management, irrigation, cultural practices, fertilizer management, and others. Among these factors, the hidden war with crops starts with weeds, causing up to 90% crop loss [17]. According to world estimates, about 50% of losses in crop yield are due to different abiotic stresses under changing climatic conditions [19, 20]. The current weed problem has been aggravated due to the cultivation of high-yielding dwarf varieties, the use of high doses of fertilizers, frequent irrigation, and an increase in cropping intensity [16, 18]. However, the growth in production has led to India becoming the world’s second-largest producer of wheat.

Physiological growth stages, the climatological approach (IW/CPE ratio), and soil moisture depletion are three fundamental techniques for scheduling wheat irrigation. Among these, the climatological method is widely recognized by scientists and researchers worldwide for its scientific accuracy and practical application. It is well-established that crop evapotranspiration at full canopy cover is closely linked to open pan evaporation, making the irrigation schedule dependent on the ratio of irrigation water (IW) to cumulative pan evaporation (CPE) [9].

Soil measurements and crop monitoring play a crucial role in informing irrigation schedules. Effective irrigation scheduling involves determining both the timing and the amount of water to be applied [10, 13]. Understanding the plant’s initial soil water content helps make informed decisions, ensuring irrigation occurs at the right time to avoid water stress that could otherwise affect crop performance [11, 24].

Accurate scheduling not only optimizes water use but also reduces costs and enhances crop quality by ensuring timely irrigation before water stress sets in. Improved irrigation timing is key to maximizing productivity and sustainability in wheat cultivation [12].

The concept of organic farming has been gaining momentum with the use of different manures, as liquid organic manures can help maintain optimum crop yield by preserving soil fertility [15]. The integrated use of inorganic fertilizers with liquid organic manures, such as cow urine, can support sustainable crop production. Cow urine contains 95% water, 2.5% urea, and 2.5% minerals, salts, hormones, and enzymes. It also contains essential minerals like iron, calcium, phosphorus, carbonic acid, potash, nitrogen, ammonia, manganese, sulphur, phosphates, potassium, urea, uric acid, amino acids, enzymes, cytokinin, and lactose [1]. Research shows that only 20% of nitrogenous materials consumed by cattle are absorbed, while 80% are excreted in urine and dung. The beneficial effects of cow urine application have been reported on several crops such as mustard [2, 3, 4], maize [5], sweet corn [6], and vegetables/fruits like watermelon [7] and lablab bean [8].

Considering these facts, the study was carried out with the objective of determining the effect of irrigation schedules and cow urine spray on the density and dry biomass of *Cynodon dactylon* and the growth attributes of wheat.

**2. Materials and Methods**

The experiment was carried out at the Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, during the rabi seasons of 2019-20 and 2020-21, using the wheat variety HD2967. A split-plot design was employed, consisting of three main plots and seven subplots, replicated three times. The main plot treatments included three irrigation levels: I1 - Irrigation Water (IW)/Cumulative Pan Evaporation (CPE) 0.7, I2 - IW/CPE 1.0, and I3 - IW/CPE 1.2.

The subplots involved different cow urine spray treatments at various growth stages of wheat: C1 - Control (no cow urine), C2 - Spray at the CRI stage, C3 - Spray at CRI + tillering, C4 - Spray at CRI + tillering + late jointing, C5 - Spray at CRI + tillering + late jointing + flowering, C6 - Spray at CRI + tillering + late jointing + flowering + milking, and C7 - Spray at CRI + tillering + late jointing + flowering + milking + maturity stages. Each treatment received a total of 4000 liters of cow urine per hectare. For instance, in treatment C3, cow urine was applied at the rate of 2000 liters per hectare during the CRI stage and another 2000 liters per hectare at the tillering stage.

Observations focused on the density and dry biomass of *Cynodon dactylon*. The collected data were analyzed using analysis of variance (ANOVA), and means were compared using the least significant difference (LSD) test at a 5% significance level.

**3. Results and Discussion**

**3.1 Effect on Density of *Cynodon dactylon***

The results indicated that the density of *Cynodon dactylon* was not significantly affected by different irrigation schedules (I) and cow urine (CU) applications at various intervals in the wheat crop during both experimental years.

**3.1.1 Effect on Density of *Cynodon dactylon* at 30 DAS**

Regarding irrigation schedules, the lowest densities of *Cynodon dactylon* were observed under **I3 (IW/CPE 1.2)**, recording **8.42** in the first year, and under **I1 (IW/CPE 0.7)**, recording **10.27** in the second year of the trial (Fig. 1). Conversely, the highest densities were noted under **I1 (IW/CPE 0.7)** in the first year (**8.09**) and under **I3 (IW/CPE 1.2)** in the second year (**11.09**) (Fig. 1). In terms of cow urine application, the minimum *Cynodon dactylon* density was recorded under **C2** (cow urine @ 4000 L at CRI) during both years of the study. On the other hand, the maximum density was observed in **C1** (Control) during the first year and in **C4** (cow urine @ 4000 L at CRI + Tillering + Late Jointing) during the second year. This aligns with Meena et al. [11], who also found that higher irrigation frequencies tended to suppress weed emergence, likely due to improved crop growth and canopy cover, which limited light availability to weeds. Conversely, the highest densities were noted under I1 in the first year (8.09) and under I3 in the second year (11.09), suggesting that irrigation frequency alone might not be sufficient to control *Cynodon dactylon* emergence.

Fig.1: Density of *Cynodon dactylon* as influenced by irrigation schedules (I) and cow urine (CU) at 30 days after sowing

**3.1.2 Effect on Density of Cynodon dactylon at 60 DAS**

The lowest density of Cynodon dactylon was recorded under **I3** in the first year and under **I1** in the second year of the trial, as shown in **Figure 2**. In contrast, the highest density was observed under **I1** during the first year and under **I3** during the second year. Regarding cow urine application, the maximum density of Cynodon dactylon was noted under **C2** in both years of the experiment (**Fig. 2**). By 60 DAS, the lowest densities were recorded under I3 in the first year and under I1 in the second year, reflecting the inconsistent effect of irrigation on *Cynodon dactylon* growth. The highest densities occurred under I1 in the first year and I3 in the second year, indicating that changes in soil moisture from varied irrigation schedules might have provided a favorable environment for *Cynodon dactylon* at different growth stages. Similar results were reported by Meena et al. [12], who highlighted that irrigation schedules influenced the growth of *Phalaris minor*, another problematic weed in wheat crops.

Fig.2: Weed density of *Cynodon dactylon* as influenced by irrigation schedules (I) and cow urine (CU) at 60 DAS

The highest density of *Cynodon dactylon* was recorded under **C1** in the first year and under **C4** in the second year of the experiment (**Fig. 2**).

**3.1.3 Effect on Density of *Cynodon dactylon* at 90 DAS**

As shown in **Fig. 3**, at **90 days after sowing (DAS)**, the lowest density of *Cynodon dactylon* was observed under **I1** in the first year and under **I2** in the second year of the study. In contrast, the highest density was recorded under **I1** during both years of the trial (**Fig. 3**). For cow urine application at **90 DAS**, the minimum density of *Cynodon dactylon* was observed under **C7** in the first year and under **C1** in the second year. Conversely, the maximum density was recorded under **C1** in the first year and under **C3** in the second year of the experiment (**Fig. 3**). These results suggest that cow urine application may have had a marginal suppressive effect on *Cynodon dactylon* density, but the effect was inconsistent across years and growth stages. Similar observations were made by Meena et al. [12], who reported that cow urine applications had minimal impact on suppressing *Phalaris minor* density, possibly due to its rapid regrowth and competitive ability.

Fig.3: Weed density of *Cynodon dactylon* as influenced by irrigation schedules (I) and cow urine (CU) at 90 DAS

**3.2 Effect on Dry Biomass of *Cynodon dactylon***

The results indicated that the dry biomass of *Cynodon dactylon* was not significantly affected by different irrigation schedules and cow urine sprays at various intervals during both years of the experiment.

**3.2.1 Effect on Dry Biomass of *Cynodon dactylon* at 30 DAS**

Regarding irrigation schedules, the lowest dry biomass was recorded under **I3** in the first year and under **I1** in the second year of the trial. Conversely, the highest dry biomass was observed under **I1** in the first year and under **I3** in the second year of the experiment (**Fig. 4**).

As for cow urine application, the minimum dry biomass was noted under **C7** in the first year and under **C2** in the second year. On the other hand, the highest dry biomass was recorded under **C1** during the first year and under **C4** in the second year of the experiment.

**3.2.2 Effect on Dry Biomass of *Cynodon dactylon* at 60 DAS**

At **60 DAS**, the lowest dry biomass was observed under **I3** in the first year and under **I1** in the second year of the trial. In contrast, the highest dry biomass was recorded under **I1** in the first year and under **I3** in the second year (**Fig. 4**). In terms of cow urine application, the minimum dry biomass was noted under **C2** in the first year, followed by **C3** in the second year. Conversely, the maximum dry biomass was observed under **C4** during both years of the experiment. **3.2.3 Effect on Dry Biomass of *Cynodon dactylon* at 90 DAS.** At **90 DAS**, the lowest dry biomass was recorded under **I3** in the first year and under **I2** in the second year of the trial. In contrast, the highest dry biomass was consistently observed under **I1** during both years of the experiment (**Fig. 4**). The findings of this study revealed that the dry biomass of *Cynodon dactylon* was not significantly influenced by different irrigation schedules or cow urine applications at various intervals during both years of the experiment. Similar results were reported by Meena et al. [11], who found that varying irrigation levels and cow urine sprays did not significantly affect the dry biomass of *Chenopodium album* in wheat.

Regarding cow urine application, the minimum dry biomass was observed under **C6** in the first year and under **C2** in the second year. Conversely, the maximum dry biomass was recorded under **C7** in both years of the experiment (**Fig. 4**). These findings are in agreement with Meena et al. [12], who concluded that cow urine had inconsistent effects on weed biomass, potentially due to its dual role as a growth stimulant and weed suppressor.

Fig.4 Dry biomass of *Cynodon dactylon* as influenced by irrigation schedules (I) and cow urine (CU) at 90 DAS

**4. Conclusion:** The findings indicated that the density and dry biomass of *Cynodon dactylon* were not significantly affected by different irrigation schedules or cow urine applications at various intervals during both years of the experiment.

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