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# Effect of integrated nutrient management on weed in sorghum + pearl millet cropping system

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**ABSTRACT**

*A field experiment was conducted at Research Farm of Fodder Section, CSKHPKV, Palampur during kharif 2019 to study the effect of integrated nutrient management on weed dynamics in sorghum-pearl mixture under rainfed conditions. The experiment was laid out in randomized block design with three replications, consisting of combinations of nitrogen, FYM and Jeevamrit.When compared to organic treatments, integrated nutrition management approaches showed lower weed density and weed dry matter accumulation.*

***Keywords :*** FYM, integrated, *jeevamrit*, nitrogen, weed

Weeds have been a major problem for the reduction of agricultural production through their impact on crop growth, yield and quality. Globally, they cause higher losses of agricultural production than other pests. Crop-weed competition is determined by weed species and density, infestation length, crop plant growth habits, and environmental conditions. This affects the growth and development of crop and leads to yield losses (Freitas *et al*., 2014). Sorghum production loss owing to weeds has been observed to range from 15 to 97 per cent, depending on the nature and strength of the weeds (Thakur *et al*., 2016). India is also said to be short of 35.6 per cent of green fodder, 10.9 per cent of dry fodder, and 44 per cent of concentrates (Anonymous, 2013). Major available forage resources in India comprises about 12 million hectare pastures and grasslands (Roy and Singh, 2013) and 8.6 million hectare cultivated forage crops (Kumar *et al*., 2012).

In Himachal Pradesh's rainfed environment, fodder sorghum [*Sorghum bicolor* (L.) *Moench*] is an important *kharif* crop. It is also called as camel crop due to its feature of resistance to drought conditions. It is a nutrient exhaustive crop and its production gets decreased in subsequent cuts. It has good palatability, acceptability to ruminants due to which it occupies 5.6 million hectare area in India (Anonymous, 2016). Pearl millet [*Pennisetum glaucum* (L) *R. Br.*] is also an important *kharif* season crop that produces a good tonnage of good-quality green herbage under limited water conditions and it occupies an area of about 6.98 million hectares in India (Anonymous, 2016). The concept of zero budget helps in maintaining ecological balance and also satisfying the conditions of the law of biological diversity. *Jeevamrit* is principally aimed at enriching the soil microflora. It is a plant growth-promoting substance containing beneficial microorganisms that promote growth and yield of crops. *Jeevamrit* is known to be economically better than the chemical fertilizers in rice (Amareswari and Sujathamma, 2014). With this in mind, as well as sorghum's greater nutrient requirements, limited availability and higher cost of weed control, the current study was designed to establish a viable weed-control measure in relation to changing fertility regimes for boosting forage sorghum productivity under rainfed fringes.

The current study took place in *kharif* 2019 at the Fodder Section, CSKHPKV, Palampur, which is located at $2^0$N latitude, $76^0$E longitude at an elevation of about 1227 metres above mean sea level in the North-Western Himalayan region, as part of an ongoing experiment that began in *kharif* 2018 under rainfed conditions. This zone has a mild temperate climate and extends from 651 metres to 1800 metres above mean sea level. The experiment comprises nine treatments *viz*., $T_1$ -10 t $ha^{-1}$ FYM + 5% *Jeevamrit*, $T_2$ -10 t $ha^{-1}$ FYM + 10% *Jeevamrit*, $T_3$ -15 t $ha^{-1}$ FYM + 5% *Jeevamrit*, $T_4$ -15 t $ha^{-1}$ FYM + 10% *Jeevamrit*, $T_5$ -50 % of recommended N + 10 t $ha^{-1}$ FYM + 5% *Jeevamrit*, $T_6$ -50 % of recommended N + 10 t $ha^{-1}$ FYM + 10% *Jeevamrit*, $T_7$ -50 % of recommended N + 15t $ha^{-1}$ FYM + 5% *Jeevamrit*, $T_8$ -50 % of recommended N + 15 t $ha^{-1}$ FYM + 10% *Jeevamrit*, $T_9$ -Recommended NPK which were tested three times in a randomized block design. The soil at the experimental site had a silty clay loam texture, was acidic in reaction (5.3), had medium accessible nitrogen, phosphorus, and potassium and had a high organic carbon content. Nitrogen was applied as per treatments and recommended phosphorus and

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potassium was applied as basal at time of sowing. The crop received 175.32 mm rainfall in 76 rainy days. The weekly ambient temperature varied from 15.92 $^0$C to 20.3 $^0$C (minimum temperature) and 24.5 $^0$C to 28.07 $^0$C (maximum temperature) from July to October. Weed density was measured at 30 and 60 days after sowing, and weed dry matter accumulation was measured at 30 days after sowing for both crops.

***Weed density***

The data on weed density (no. m$^{-2}$) at 30 days after sowing and 60 days after sowing, as influenced by different nutrient management system have been presented in Table 1 and 2, respectively. After 30 days of sowing major weed species observed were *Ageratum conyzoides*, *Bidens pilosa,Polygonum alatum* and *Cyperus rotundus*. *Ageratum conyzoides* was the dominant weed at 30 days after sowing. Significant effect of treatments was observed on *Ageratum conyzoides* and *Cyperus rotundus* weed count, while effect on *Polygonum alatum* and *Bidens pilosa* count were non significant. Significantly lower weed count of *Ageratum conyzoides* was recorded with 50 per cent recommended N + 15 t ha$^{-1}$ FYM + 5 per cent *Jeevamrit* and was at par with 50 per cent recommended N + 15 t ha$^{-1}$FYM + 10 per cent *Jeevamrit* and 50 per cent recommended N + 10 t ha$^{-1}$FYM + 5 per cent *Jeevamrit*. Lower count of *Bidens pilosa* and *Polygonum alatum* was recorded with 50 per cent recommended N + 10 t ha$^{-1}$ FYM + 10 per cent *Jeevamrit* and 50 per cent recommended N + 15 t ha$^{-1}$FYM + 10 per cent *Jeevamrit*, respectively. In general weed count was higher in treatments with organic nutrient management (FYM + *Jeevamrit*) and integrated nutrient management and recommended NPK.

At 60 days after sowing five different major weed species *Echinochloa colona*, *Elucine indica*, *Cyperus rotundus*, *Ageratum conyzoides* and *Polygonum alatum* were noticed and a non significant effect was found in their population under different treatments of the present study. An application of 50 per cent recommended N + 15 t ha$^{-1}$FYM + 10 per cent *Jeevamrit* resulted in lower weed count in *Echinochloa colona*, *Elucine indica*, *Ageratum conyzoides* and *Polygonum alatum* while recommended NPK gave lower weed count in *Cyperus rotundus*.

A careful observation of the data showed higher population of weed under organic sources as compared to integrated nutrient management and recommended NPK practices. Better growth of crop under integrated nutrient management and recommended NPK, as evident in the present study, offer sufficient competition to weeds hence suppress the growth of the associated weeds. Walia *et al*. (2014) also found that rice-wheat cropping systems with recommended NPK and integrated nutrient

**Table 1: Effect of different nutrient management treatments on species-wise weed count (No. m$^{-2}$) at 30 DAS**

| Treatment | *Echinochloa colona* | *Elucine indica* | *Cyperus rotundus* | *Ageratum conyzoides* | *Polygonum alatum* |
|---|---|---|---|---|---|
| 10 t ha$^{-1}$FYM + 5% *Jeevamrit* | 6.49 (36.00) | 6.33 (36.00) | 3.23 (7.67) | 5.15 (22.67) | 3.2 6(8.00) |
| 10 t ha$^{-1}$FYM + 10% *Jeevamrit* | 6.02 (30.67) | 6.16 (32.33) | 3.66 (10.33) | 4.93 (30.67) | 2.93 (9.33) |
| 15 t ha$^{-1}$FYM + 5% *Jeevamrit* | 6.02 (30.67) | 6.37 (34.67) | 2.50 (6.67) | 5.21 (22.67) | 2.94 (9.00) |
| 15 t ha$^{-1}$FYM + 10% *Jeevamrit* | 6.24 (33.33) | 6.67 (38.67) | 3.23 (7.67) | 6.13 (32.00) | 4.13 (14.67) |
| 50% recommended N + 10 t ha$^{-1}$FYM + 5% *Jeevamrit* | 5.90 (29.33) | 5.87 (30.67) | 2.39 (5.33) | 4.78 (18.67) | 3.05 (6.67) |
| 50% recommended N + 10 t ha$^{-1}$ FYM + 10% *Jeevamrit* | 5.25 (24.00) | 5.35 (24.00) | 2.11 (4.00) | 3.42 (8.67) | 2.39 (5.33) |
| 50% recommended N + 15 t ha$^{-1}$ FYM + 5% *Jeevamrit* | 5.62 (26.67) | 5.57 (26.67) | 2.91 (6.00) | 3.93 (12.00) | 3.17 (7.33) |
| 50% recommended N + 15 t ha$^{-1}$ FYM + 10% *Jeevamrit* | 5.04 (20.67) | 3.65 (10.00) | 2.05 (3.67) | 2.99 (9.33) | 1.64 (2.00) |
| Recommended NPK | 5.23 (22.67) | 5.15 (22.67) | 1.17 (1.33) | 3.23 (7.67) | 2.82 (6.00) |
| **LSD (0.05)** | **NS** | **NS** | **NS** | **NS** | **NS** |

*Values in parentheses are means of original values; Data transformed to square root transformation ($\sqrt{x+0.5}$)

**Table 2: Effect of different nutrient management treatments on species-wise weed count (No. /m$^{-2}$) at 60 DAS**

| Treatment | *Ageratum conyzoides* | *Bidens pilosa* | *Polygonum alatum* | *Cyperus rotundus* |
|---|---|---|---|---|
| 10 t ha$^{-1}$ FYM + 5% *Jeevamrit* | 27.42 (726.67) | 5.33 (25.33) | 3.60 (14.67) | 12.10 (134.67) |
| 10 t ha$^{-1}$FYM + 10% *Jeevamrit* | 22.28 (474.67) | 4.91 (20.00) | 4.23 (14.67) | 9.80 (86.67) |
| 15 t ha$^{-1}$FYM + 5% *Jeevamrit* | 17.64 (294.67) | 4.02 (18.67) | 4.93 (21.33) | 10.15 (93.33) |
| 15 t ha$^{-1}$ FYM + 10% *Jeevamrit* | 20.50 (400.00) | 6.34 (34.67) | 4.70 (18.67) | 9.77 (86.00) |
| 50% recommended N + 10 t ha$^{-1}$ FYM + 5% *Jeevamrit* | 10.24 (95.33) | 2.78 (8.00) | 3.72 (10.67) | 8.05 (57.33) |
| 50% recommended N + 10 t ha$^{-1}$ FYM + 10% *Jeevamrit* | 12.92 (154.67) | 2.44 (5.67) | 4.09 (13.33) | 8.87 (71.67) |
| 50% recommended N + 15 t ha$^{-1}$ FYM + 5% *Jeevamrit* | 10.07 (92.00) | 2.47 (6.00) | 4.27 (14.67) | 8.65 (66.67) |
| 50% recommended N + 15 t ha$^{-1}$ FYM + 10% *Jeevamrit* | 11.83 (129.33) | 2.47 (6.00) | 2.60 (6.67) | 8.05 (57.33) |
| Recommended NPK | 17.36 (290.67) | 3.69 (15.33) | 3.60 (10.67) | 9.29 (80.00) |
| **LSD (0.05)** | **2.35** | **NS** | **NS** | **1.39** |

*Values in parentheses are means of original values; Data transformed to square root transformation (√x+0.5)

**Table 3: Effect of different nutrient management treatments on weed dry matter accumulation (kg ha$^{-1}$) at 30 DAS**

| Treatment | *Ageratum conyzoides* | *Bidens pilosa* | *Polygonum alatum* | *Cyperus rotundus* |
|---|---|---|---|---|
| 10 t ha$^{-1}$FYM + 5% *Jeevamrit* | 52.64 (2725.00) | 5.33 (25.33) | 6.50 (55.00) | 12.10 (134.67) |
| 10 t ha$^{-1}$ FYM + 10% *Jeevamrit* | 42.69 (1780.00) | 2.47 (6.00) | 7.72 (55.00) | 9.80 (86.67) |
| 15 t ha$^{-1}$ FYM + 5% *Jeevamrit* | 33.69 (1105.00) | 4.02 (18.67) | 9.09 (80.00) | 10.15 (93.33) |
| 15 t ha-$^{-1}$ FYM + 10% *Jeevamrit* | 39.22 (1500.00) | 6.34 (34.67) | 8.63 (70.00) | 9.77 (86.00) |
| 50% recommended N + 10 t ha$^{-1}$ FYM + 5% *Jeevamrit* | 19.35 (357.00) | 2.78 (8.00) | 6.73 (40.00) | 8.05 (57.33) |
| 50% recommended N + 10 t ha$^{-1}$ FYM + 10% *Jeevamrit* | 24.56 (580.00) | 2.44 (5.67) | 7.45 (50.00) | 8.87 (71.67) |
| 50% recommended N + 15 t ha$^{-1}$ FYM + 5% *Jeevamrit* | 19.04 (345.00) | 4.91 (20.00) | 7.79 (55.00) | 8.65 (66.67) |
| 50% recommended N + 15 t ha$^{-1}$ FYM + 10% *Jeevamrit* | 22.45 (485.00) | 2.49 (6.00) | 4.56 (25.00) | 8.65 (66.67) |
| Recommended NPK | 33.16 (1090.00) | 3.99 (18.67) | 6.50 (40.00) | 8.05 (57.33) |
| **LSD (0.05)** | **4.56** | **NS** | **NS** | **1.15** |

*Values in parentheses are means of original values; Data transformed to square root transformation (√x+0.5)

management strategies had the lowest weed count when compared to treatments that used only organic sources of nutrients.

The data pertaining to the effect of different nutrient management practices on weed dry matter accumulation (kg $ha^{-1}$) after 30 days of sowing have been presented in Table 3.

After 30 days of sowing a significant effect was observed on dry matter accumulation of *Ageratum conyzoides* and *Cyperus rotundus* while effect was non significant on dry matter accumulation of *Polygunum alatum* and *Bidens pilosa*. Significantly lower weed dry matter accumulation of *Ageratum conyzoides* was recorded under 50 per cent recommended N + 15 t $ha^{-1}$FYM + 5 per cent *Jeevamrit* and was at par with 50 per cent recommended N + 15 t $ha^{-1}$ FYM + 10 per cent *Jeevamrit* and 50 per cent recommended N + 10 t $ha^{-1}$FYM + 5 per cent *Jeevamrit*. Lower weed dry matter accumulation of *Bidens pilosa* and *Polygonum alatum* was recorded with 50 per cent recommended N + 10 t $ha^{-1}$FYM + 10 per cent *Jeevamrit* and 50 per cent recommended N + 15 t $ha^{-1}$FYM + 10 per cent *Jeevamrit*, respectively. The application of 50 per cent recommended N + 15 t $ha^{-1}$FYM + 10 per cent *Jeevamrit* and 50 per cent recommended N + 10 t $ha^{-1}$FYM + 5 per cent *Jeevamrit* was statistically at par with all other integrated nutrient management practices and recommended NPK.

Organic treatments resulted in higher weed dry matter accumulation than prescribed NPK and integrated nutrient management approaches, according to the findings reported in Table 3. In the current study, increased weed count in organic treatments resulted in higher weed dry matter accumulation 30 days after sowing. In comparison to solitary application of organics, Walia *et al*. (2014) found that prescribed NPK and integrated nutrient management approaches resulted in the lowest weed dry matter buildup in rice-wheat cropping systems.

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