

Effect of Glyphosate Spray on Seed Yield and Quality Attributes in Watermelon (*Citrullus vulgaris*) cv Sugar Baby

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ABSTRACT Efficacy of glyphosate (nonselective herbicide) against obnoxious weeds by adopting a new spraying technique and its subsequent effect on seed yield and its quality was evaluated in watermelon at research farm, Indian Agricultural Research Institute, Karnal during summer season of 2000 and 2001. Glyphosate being non residual and translocated herbicide was applied on weed foliage after covering the watermelon plants fully with plastic pots 20 days after sowing. Glyphosate (1.0 and 0.5 %) reduced the weed density and weed dry weight significantly over two and one hand weeding and weed check. Application of glyphosate 1.0 % alongwith one hoeing increased the fruit and seed yield significantly over check, two hand weeding and one hand weeding. Seed yield remained significantly at par under different levels of glyphosate. Seed quality in terms of per cent germination was not affected due to different weed control treatments. However, 1000 seed weight, seedling dry weight and vigour index was maximum with glyphosate 1.0% compared to weed check and one hand weeding.

Keywords: Yield, quality, watermelon, herbicide, spraying, technique

Watermelon is sown during spring summer season, the time coincides with the germination of weeds, particularly Purple Nut Sedge (*Motha*) (*Cyperus rotundus*), Canada thistle (Kandeli) (*Cirsium arvense*) and Carpet grass (Itsit) (*Trianthema portulacastrum*) under North Indian conditions. These obnoxious weeds particularly *Cyperus rotundus* and *Cirsium arvense* exhibit prolific vegetative activity with its complex underground system of basal bulb, rhizomes and tubers and are difficult to control. Manual weeding fails to control the weeds in watermelon fields, heavily infested by *Cyperus rotundus*, because underground rhizomes give rise to new shoots, besides it is time consuming, expensive and labour availability during peak period is less. Glyphosate has been recommended to combat such perennial and persistent weed [1&2]. Glyphosate (N- Phosphonomethyl glycine- isopropyl amine salt) a broad spectrum, post emergent, translocated and nonselective herbicide with an application technique is the best choice for the long-term control of *Cyperus rotundus*. Glyphosate shows no pre-emergence or residual soil activity [3]. The non-residual soil activity of glyphosate enabled to utilize this herbicide on weed foliage post emergently after covering the non-targeted plants (watermelon). An experiment was planned to evaluate the efficacy of glyphosate with a new

application technique for weed control, its subsequent impact on seed yield and seed quality of watermelon.

MATERIALS AND METHODS

Field experiment was conducted at Regional Research Station, Indian Agricultural Research Institute, Karnal with watermelon cv. Sugar Baby during spring season in 2000 and 2001. The soil of experimental area was clay loam in texture having pH 7.9, organic carbon 0.45% electrical conductivity 0.31m mhos/cm and 130, 29 and 310 kg/ha available N P and K respectively. The treatments comprising blanket spray of glyphosate 1% and 0.5 % on weed foliage after shielding the non targeted plants i.e. watermelon plants; + one hoeing near the plant base at 20 days after sowing, two hand weeding (one at 20 and 40 days after sowing) one hand weeding (20 days after sowing) and weedy check were tried in randomized block design with four replications. Watermelon cultivar Sugar baby seeds were sown in furrow bed methods i.e. seeds were sown on the topside of the furrow 50 cm apart and vines were allowed to trail on the raised bed (1.5 meter wide on either side) on 14 and 18 March during 2000 and 2001 respectively. Crop was uniformly fertilized with recommended dose of N, P, and K. Weed density

Table 1. Effect of different weed control treatments on seed yield and quality of watermelon (Mean of two years)

Treatments	Weed density (g/m ²)	Weed dry weight (g/m ²)	Fruit yield (q/ha)	Seed yield (kg/ha)	1000 seed weight (g)	Germination (%)	Seed length (mm)	Seedling dry wt. (mg)	Vigour index
Glyphosate 1 % +I Hoeing	(47) 06.79	16.05	319.9	181.40	42.22	90.25	7.55	17.97	1622.2
Glyphosate 0.5 % +I Hoeing	(84) 09.11	30.42	295.1	173.48	41.58	89.75	7.45	17.97	1608.5
Two Hand weeding	(124) 11.18	56.05	275.7	150.45	40.96	89.75	7.30	17.65	1583.7
One Hand Weeding	(172) 13.10	94.21	158.1	106.08	39.59	89.75	6.90	16.48	1477.4
Weedy check	(483) 21.99	246.61	74.07	45.48	38.58	88.50	6.50	15.13	1336.5
CD (p= 0.05)	1.43	20.69	24.71	26.78	1.83	NS	0.53	0.75	67.70

Figures in parenthesis denotes original values

was recorded in the quadrates of 1x1m² randomly in each plot. Weed dry weight was recorded after drying the weed biomass in hot air oven at 70 ±1° C for 72 hr and reported as g/m². Two roguing were done to bring seed plot to seed certification standard. Weight of mature fruits was recorded from each plot. Seed was extracted manually from the fruits of each plot (6x3m²) per replication, washed cleaned and air-dried. Germination (%) was recorded according to ISTA [4]. The seedling dry weight was recorded on ten random seedlings. Seedling vigour was calculated according to Abdul Baki and Anderson [5]. In watermelon crop, (at three to four leaf stage, 15 to 20 days after sowing) individual plants were fully covered with plastic pots. Blanket spray of 1.0 and 0.5 % glyphosate (41 % SL) @ 500 liters / ha was done on weed foliage. After the spraying, the pots were dried to avoid any herbicide droplet adhering to outer surface before shifting to other place. Pots were not stacked during shifting and were carried individually. Glyphosate was applied when the weeds were green and actively growing. Since Glyphosate is a systemic and translocated herbicide therefore, complete wetting of foliage was not essential (do not spray up to run off point).

RESULTS AND DISCUSSION

The major weed flora infesting the experimental field were Purple nut sedge (*Cyperus rotundus*), Canada thistle (*Cirsium arvense*), Carpet weed (*Trianthema portulacastrum* L.), Jungle rice (*Echinochloa colonum* L.), Crow foot grass (*Dactyloctenium aegyptium* L.), and Carrot grass (*Parthenium hysterophorus* L.), which constituted 72.5, 4.1, 4.1, 10.3, 6.2 and 3.7 % respectively of total weed density. All the treatments significantly reduced the weed density and weed dry weight of weeds compared to weed check.

Among herbicide doses of 1.0 and 0.5 % of glyphosate with hoeing were found most effective in reducing the weed infestation with weed control efficiency of 93.5 and 87.6 % compared to 77.9 and 61.7 % with two and one hand weeding. Lower weed control efficiency in hand weeded plots was due to presence of *Cyperus rotundus* which consist of well developed rhizomes and tubers which gave rise to new shoots very fast. Both weed density and weed dry weight was significantly higher in one and two hand weeding compared to glyphosate 1.0 and 0.5 % (Table1).

Weed control treatments improved fruit yield/ ha significantly over weed check. Reduction in fruit yield was 90.8 % in weed check compared to Glyphosate 1.0% + hoeing treatment. Fruit yield was significantly lower (13.8 and 50.5%) in two and one hand weeding compared to glyphosate 1.0 % +hoeing. Glyphosate being broad spectrum and shoot -translocated herbicide destroys the roots and rhizomes of *Cyperus rotundus* and *Cirsium arvense*, which results in weed free conditions for the crop. Significant improvement in fruit yield/ ha could be attributed possibly to the increased availability of nutrients, moisture, space and sunlight to the crop as a consequence of reduced weed crop competition under these treatments.

Seed yield reduced 74.9 and 41.5% in weed check and one hand weeding compared to glyphosate 1.0 % +hoeing. Since seed yield is a function of the weight of fruit significant improvement of fruit weight enhances the seed yield of watermelon under glyphosate 1.0 % followed by glyphosate 0.5 % and hoeing. Dev *et al* [6] also recorded 30-81% increase in yield of soybean by controlling the *Cyperus rotundus* with glyphosate. Seed yield between two glyphosate treatments remained statistically at par.

Hand weeding twice-recorded significantly lower seed yield compared to glyphosate treated plots but it was significantly more than one hand weeding and weed check.

Weed stress to the mother plants significantly affected the seed quality parameters of watermelon. Seed size (seed length) was reduced by 13.9% in weed check compared to glyphosate 1.0% treatment. Weed free conditions ensured proper nutrition to mother crop, which helped in production of bolder seeds. The 1000 seed weight increased with increase in seed size (Table 1), which was highest in glyphosate treated plots followed by two-hand weeding. One hand weeding was not sufficient to produce bolder seeds and there was significant reduction in 1000 seed weight compared to glyphosate 1.0 and 0.5 % respectively. Parkash and Singhal [7] reported increased seed weight as influenced by size of seed in wheat. Chopra *et al* [8] also recorded lower seed size and 1000 seed weight under weed check conditions compared to weed free conditions.

Per cent germination was not significantly affected in watermelon and per cent germination was recorded over the minimum seed certification standard in all the treatment. The seedling dry weight was significantly more in glyphosate 1.0 and 0.5% and two hand weeding than one hand weeding and weed check indicative of vigour which increased with increase in seed size and 1000 seed weight. Higher dry weight of seedlings is due to the bolder size indicates good food reserve. Thimmahaiah *et al* [9] also reported that bolder seeds had significantly higher dry weight of seedling compared to medium and small seeds. The vigour index was lower in treatments under weed stress. The seedling vigour index is indicative of quality of seed, which was being changed with weed stress possibly because of

sharing of food, space and sunlight between mother crop and weeds.

The results indicate that spraying of glyphosate @ 1.0 and 0.5 % + one hoeing was found to be most effective weed control method for realizing the higher seed yield and quality in watermelon seed crop.

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