Effect of a soil moisture retentive material on yield, quality and nutrient accumulation in cowpea and water retention in soil

K.A. Nangare[A], M.R. Nagrale[B], S.S. Dhane[C] and Harmandeep Singh[D]

[A]Vasantdada Sugar Institute, Pune, Maharashtra, India, Email nangare_kiran1936@rediffmail.com
[B]Agricultural Chemistry and Soil Science, Konkan Krishi (Agricultural) Vidyapeeth (University), Dapoli, Maharashtra, India
[C]Agricultural Chemistry and Soil Science,Konkan Krishi (Agricultural) Vidyapeeth (University), Dapoli, Maharashtra, India, Email headacss@rediffmail.com
[D]International Plant Nutrition Institute, Pune, Maharashtra, India, Email hsingh@ipni.net

Abstract
Cowpea (*Vigna unguinculata (L.)* Walp) is an important legume crop of Maharashtra that is usually grown on residual soil moisture. To increase water use efficiency and reduce irrigation water frequency in cowpea, a soil moisture retentive material "All Purpose Spray Adjuvant-80 (APSA-80™)" was tested and standardized for its effect on yield, growth, nutrient accumulation, saving of irrigation water, and moisture retention at 0-15 and 15-30 cm depths in a lateritic soil of Konkan under cowpea (var. Konkan Sadabahar). Treatment receiving APSA-80™ at 2 mL/L and irrigation at 20 d intervals gave maximum yield of cowpea, retained maximum moisture content, and improved available nutrient status in the studied soil.

Key Words
All Purpose Spray Adjuvant-80, cowpea, irrigation water, moisture retention, yield, nutrient accumulation

Introduction

All Purpose Spray Adjuvant-80™ (APSA-80) is a soil moisture retentive material that possesses an exceptional affinity to absorb and retain large quantities of water (Mukherjee *et al.* 2009). It releases and reabsorbs water repeatedly, which helps in good seed germination, and thus, contributes to increasing crop yields (Anonymous 2007). When it comes in contact with soil it spreads uniformly all over the soil surface, gets absorbed and holds soil particles tightly, thus, reducing the rate of evaporation and improving soil aggregation (Raghavan 2007). The application of APSA-80 can, thus, help to considerably reduce frequency of irrigation and irrigation water requirements of crops, and improve crop water-use efficiency.

Cowpea (*Vigna unguinculata* L. Walp) is an important legume crop with regard to nutrition, as it is a major source of protein with minerals and vitamins. In Maharashtra, cowpea is grown in the *rabi* (winter) season on residual soil water. So we tested APSA-80 in cowpea grown in the lateritic soils of the Konkan with the objectives of evaluating its effect on a) growth, b) yield, and c) nutrient accumulation, d) saving of irrigation water and e) water retention at 0-15 and 15-30 cm depths.

Methods

We conducted a feeler pot culture trial in 2008 using RBD and three replications to test the efficacy of APSA-80 (manufactured by Amway) as a soil moisture retainer for lateritic soils in cowpea (var. Konkan Sadabahar). The soil was brought to saturation and tensiometer readings were recorded against lapse of time for 28 d to measure soil moisture depletion. Treatments included irrigation at 10d intervals (control) (T_1), irrigation at10 d intervals with polyethylene mulch (PE) mulch (T_2), irrigation at 20 d intervals with APSA-80™ (1 mL/L) (T_3), irrigation at 20 d intervals with PE mulch and APSA-80 (1 mL/L) (T_4), irrigation at 20 d intervals and APSA-80™ (2 mL/L) (T_5), irrigation at 20 d interval with PE mulch and APSA-80™ (2 mL/L) (T_6), irrigation at 20 d intervals and APSA-80™ (3 mL/L) (T_7), and irrigation at 20 d intervals with PE and APSA-80™ (3 mL/L) (T_8). Our university recommended macronutrient application should be made with 25:50:0 N:P_2O_5:K_2O.

Results

Crop growth and yield contributing parameters, *viz.,* number of leaflets, primary branches, height of plants, no. of pods and 1000-seed weight, total nutrient uptake, and seed yield of cowpea were improved significantly with the application of APSA-80 alone, and in combination with and without polyethylene mulch when compared with control. The application of APSA-80™ at 2 mL/L (T_5) showed marked improvement in all the above characters over application of irrigation at 10 d interval without and with mulch i.e. (T_1 & T_2). Treatment T_5 registered the highest grain yield (15.5 q/ha) (Table 1), nutrient uptake, and water holding capacity of the studied soil. The use of polyethylene mulch in combination with APSA-80

in different quantities increased the stover yield of cowpea in comparison with the application of APSA-80 alone (Table 1). However, application of APSA-80 alone responded more favorably towards the availability of the nutrients at the harvest of the crop (Table 2).

Table 1. Effect of All Purpose Spray Adjuvant-80 (APSA-80™) on grain and stover yield of cowpea.

Tr. No.	Treatments	Yield (q/ha) and % increase over control (in parenthesis)	
		Grain	Stover
T_1	Control (Irrigation at10 d intervals)	10.23	31.5
T_2	T_1 + polyethylene mulch	11.0 (7.6)	41.2 (30.7)
T_3	Irrigation at 20 d intervals + APSA-80 at 1 mL/L	10.2 (6.0)	32.4 (3.0)
T_4	T_3 + polyethylene mulch	12.5 (22)	40.4 (28.3)
T_5	Irrigation at 20 d interval+ APSA-80 at 2 mL/L	15.5 (51.7)	37.13 (17.87)
T_6	T_5 + polyethylene mulch	11.3 (10.3)	39.4 (25.0)
T_7	Irrigation at 20 d interval+ APSA-80 at 3 mL/L	12.5 (22.2)	35.3 (11.9)
T_8	T_7 + polyethylene mulch	12.2 (19.3)	38.5 (22.3)
	Mean	12.0	37.0
	SEm ±	0.4	0.4
	CD (P=0.05)	1.4	1.2

Table 2. Effect of All Purpose Spray Adjuvant-80 (APSA-80™) on availability of macronutrients at harvest of cowpea.

Tr. No.	Treatments	Ava. N (kg/ha)	Ava. P_2O_5 (kg/ha)	Ava. K_2O (kg/ha)
T_1	Control (Irrigation at10 d intervals)	338.8	10.9	213.5
T_2	T_1 + polyethylene mulch	333.5	12.1	218.2
T_3	Irrigation at 20 d intervals + APSA-80 at 1 mL/L	327.3	12.5	221.9
T_4	T_3 + polyethylene mulch	325.2	13.1	223.5
T_5	Irrigation at 20 d interval+ APSA-80 at 2 mL/L	312.1	13.7	238.1
T_6	T_5 + polyethylene mulch	314.6	13.6	233.9
T_7	Irrigation at 20 d interval+ APSA-80 at 3 mL/L	316.8	13.6	228.1
T_8	T_7 + polyethylene mulch	322.1	13.4	225.1
	Mean	323.8	12.8	225.3
	SEm ±	0.66	0.60	0.005
	CD (P=0.05)	2.00	NS	0.016

Conclusion

Treatment receiving APSA-80 at 2 mL/L and irrigation at 20 d intervals gave maximum yields of cowpea, retained maximum water content, and improved available nutrient status of the studied soil.

References

Mukherjee I, Haldar D, Ghosh S, Moulik SP (2009) Physicochemical Studies on an All-Purpose Pesticide Spray Adjuvant-(APSA-80™). *Journal of Dispersion Science and Technology* **30**, 1430-1441.

Raghavan R (2007) Creator of APSA-80™ in city to promote product. *Pune Newline* (Indian Express) (http://cities.expressindia.com/fullstory.php?newsid=244938)

Anonymous (2007) APSA-80™: Big Ground Nut. Video posted online at: http://revver.com/video/454972/APSA-80™-big-ground-nut/