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Aonla based intercropping fetches more under dryland conditions

For sustainable crop production in dryland conditions, growing of intercrop in fruit orchard, farmers can maximize the water use efficiency, maintain soil fertility, reduce the weed growth, minimize the soil erosion, full utilization of intrspaces left in orchard, which ultimately leads to sustainable production and doubling the farm income. Keeping these points in mind, different combinations of cucurbitaceous crops, viz. aonla + bottlegourd, aonla + pumkin, aonla + bitter goud, aonla + cucumber and aonla + sponge gourd were investigated in the NA-7 aonla orchard, sapced at 10 m×10 m, attained the age of 8 years, grown uder rainfed semi-arid conditions. Results of study revealed that the aonla based intercopping with cucurbits in *kharif* is practically feasible and economically viable under rainfed semi-arid ecosystem. Among the different cucurbits tried as an intercrops, net economic return to the tune of ₹147312.80/ha with the B:C ratio 4.44 was achieved in aonla + bottle gourd followed by aonla + pumpkin combination under purely rainfed conditions of semi-arid ecosystem of western India. In order to obtain more sustainable returns in dryland condition, intercropping not only enhances the productivity and income but also utilizes the unutilized space left in orchards.

THE aonla *(Emblica officinalis* Gremtn) is an indigenous fruit of India. It is very popular for its medicinal properties in different ayurvedic formulations. Owing to its hardiness, it is not very specific in its soil and climatic requirements, hence it thrives well in different kinds of wastelands. However, it grows well in sandy loam to clay soils having soil pH up to 8.5. The aonla variety NA-7 plants start bearing from 3rd year of planting and reach to their maximum production capacity within 10-12 years after planting under rainfed conditions. Generally, the aonla crop is grown at spacing of 10 m × 10 m and the interspaces between the two rows, especially in the early years of orchard life, can be utilized for growing intercrops to get additional income. The interspacing can be occupied by growing ground storey intercrops of ephemeral cucurbitaceous rainy season vegetable crops which could be helpful to get more benefits, check the soil erosion and weed growth also improve the physico-chemical properties of the soil.

Mature fruits of NA-7 aonla in intercropping

The advantages of intercropping are commonly attributed to the complementarily of resources capture patterns by crops and better input management particularly during long initial period of sole fruit crops. The present study was aimed for determining the feasibility of intercropping in aonla orchard with cucurbitaceous crops, viz. bottle guard, pumpkin, cucumber, bitter gourd and sponge gourd for increasing the productivity per unit area in aonla orchard under rainfed hot semi-arid conditions of western India.

Soil and climate

The location is characterized by hot semi-arid climate. The annual rainfall is mainly confined to three months (July-September) which may occur unevenly and erratic in manner. Actual mean precipitation is about 750 mm, and the total number of rainy days average to about 29. The mean summer temperature is 32.9°C while the mean winter temperature is 21.3°C indicating that the area falls under hyperthermic soil regime. The mean

Table 1. Productivity and economics of aonla based cropping system in dryland

Intercrops	Details of cost and benefits from intercrops					Details of cost benefits from sole crop of aonla					B:C ratio		
	Produce of intercrop (q/ha)	Rate (₹/ kg)	Cost of cultivation/ ha (₹)	Gross income (₹)	Net income (₹)	Produce of main crop (q/ ha)	Rate (₹/ kg)	Cost of cultivation (₹)	Gross income (₹)	Net income (₹)	Input costs (₹)	Total net return (₹)	B:C ratio
Aonla + Bottle gourd	79.95	15.00	18142.20	119925.00	101782.80	60.53	10	15000	60530.00	45530.00	33142.20	147312.80	4.44
Aonla+ Pumpkin	74.40	10.00	17225.00	074400.00	057175.00	58.35	10	15000	58350.00	43350.00	32225.00	100525.00	3.11
Aonla + Bitter gourd	49.14	15.00	18035.50	073710.00	055674.50	56.03	10	15000	56030.00	41030.00	33035.50	96704.50	2.92
Aonla + Cucumber	68.61	10.00	16054.83	068610.00	052555.17	52.85	10	15000	52850.00	37850.00	31054.83	90405.17	2.91
Aonla + Sponge gourd	43.73	10.00	15147.57	043730.00	028582.43	59.50	10	15000	59500.00	44500.00	30147.57	73082.43	2.42
Sole aonla (farmers practice)	-------	------	---------	----------	--------	64.65	10	15000	64650.00	49650.00	01500.00	49650.00	------

annual maximum and minimum temperatures vary from 42-44°C during May and 6-9°C in January, respectively. The average highest monthly evaporation rate (11.8 mm/ day) is recorded in May and lowest in September (1.3 mm/day) during the experimentation. The soil is clay to clay loam, soil depth ranges from 0.75-1.0 meter, derived from mixed alluvial basalts, quartzite, granite, and having layers of limestone just below the soil depth.

Yield and economic benefits are presented in Table 1. Among the different combinations, the yield was recorded the maximum in aonla + bottle gourd combination (140.48 q/ha) followed by aonla + pumpkin (132.75 q/ha), aonla + cucumber (121.46 q/ha), aonla + bitter gourd (105.17 q/ha) whereas as cumulative yield was recorded the lowest in aonla + sponge gourd (103.23 q/ ha) without affecting the growth and yield of sole crop

Aonla based intercropping at CHES, Godhra

aonla. Whereas the minimum cumulative yield was recorded in aonla+sponge gourd (103.23 q/ha) among the various combination tried. The combination aonla + bottle guard was adjudged as very efficient resource user as sole cropping counterpart under rainfed conditions. Similarly, net profit/ha was also recorded the highest with aonla + bottle goud combination (₹147312.80) followed by aonla + pumpkin (₹100525.00) and it was recorded least in aonla + sponge gourd combination. The B:C ratio was maximum in aonla + bottle gourd (4.44) followed by aonla + pumpkin (3.11) and it was recorded minimum in aonla + sponge gourd (2.42). The results indicated that the aonla + bottle gourd combination performed better in the terms of productivity/ha and net economic return. This combination is being practiced by the aonla growers of Gujarat.

SUMMARY

As a general conclusion, through intercropping, farmers can achieve the full production of the main crop and also an additional yield (bonus) associated with an increased plant population of the second component. Hence, intercropping can increase income obtained by smallholder farmers through reduction of economic risk and market fluctuation resulting from growing a single crop which is more prone to natural hazards and helping the farmers in better utilization of land by having more than one crop produced per unit area. Keeping in view the moisture availability in soil under rainfed condition, it becomes imperative to select the crops which complete their reproductive phase during maximum moisture availability period (*kharif*). By adopting the practice of growing intercrops (cucurbits) in the interspaces available in aonla orchard, the farmers can generate additional income under rainfed semi arid ecosystem. which not only enhances the productivity and better returns but also improve the socio-economic conditions of resource poor farmers of rainfed hot semi-arid conditions.

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