

Integration of β -carotene enriched orange sweet potato in aquaculture for enhanced nutrition accessibility by small fish farmers



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BACKGROUND

- Sweet potatoes, *Ipomoea batatas*, is a tropical perennial crop usually grown as an annual.
- Worldwide it has been grown from plains to the high hills up to 2500 m asl having with at least five frost free months.
- It grows from underground tuberous storage roots with trailing and twisting stems that can be as long as six meters.
- It is a rich source of energy, dietary fibers, Vitamin C, potassium, iron and other micronutrients. Orange sweet potatoes (OSP) are additionally enriched with β -carotene, the precursor of vitamin A.
- Consumption of 125 g of storage roots of OSP can fulfill the daily vitamin A requirement of a child.
- It can be a miracle food crop to combat with the nutrition and vitamins deficiencies prevailing among the children, and pregnant and lactating women, especially in rural communities.

OSP Nutrition

Sweet Potato, baked
1.00 medium
(200.00 grams)

Calories: 180
GI: medium

Nutrient	DR%DV
vitamin A	214%
vitamin C	52%
manganese	50%
copper	36%
pantothenic acid	35%
vitamin B6	34%
biotin	29%
potassium	27%
fiber	26%
vitamin B3	19%
vitamin B1	18%
vitamin B2	16%
phosphorus	15%

Nutritional Benefits of OSP

- **Vision:** Great for vision as rich in vitamin A (β -carotene).
- **Energizing:** A rich source of energy due to its supply of complex carbohydrates
- **Digestion:** A good source of fiber that promotes healthy digestion and prevents colon cancer
- **Diabetic-friendly:** Great for diabetics, as help stabilize blood sugar levels and medium on glycemic index (adiponectin)
- **Cancer fighting:** A cancer fighting food due to Vitamins A and C, antioxidants that works to remove free radicals in the body
- **Anti-inflammatory:** Vitamins A and C are anti-inflammatory nutrients, making sweet potatoes an excellent food choice for those suffering from arthritis or asthma

OBJECTIVE

- To identify the elite orange sweet potato genotype(s) for high yield and adoptability so that the small fish farmers, thereafter, can integrate orange sweet potatoes in their pond dikes and hence their nutrition accessibility enhanced.

MATERIALS AND METHODS

Exp. Date: Summer season of 2013/14

Exp. Design: RCBD, replicated four times

Genotypes (5)

4 elite OSPs: CIP 440015, CIP 440021,
CIP 440185 and CIP 440267

1 standard check: *Japanese Red*

Locations/Replications

Tareni, Patkhauli-1 and
Shankarpur, Siktahan-7 of Rupandehi district
Bhatauliya, Jahada-9 and
Dhanewa, Jahada-3 of Nawalparasi district

Plot size: Eighty stem cuttings with 60 x 30 cm
spacing, i.e. 14.4 m²

Fertilizers: 30:30:50 NPK kg/ha

OSP planted in the pond dikes



CIP 440015



CIP 440185

OSP planted in the pond dikes



CIP 440267



CIP 440021

SP used as Standard Check



ACTIVITIES

1. Plantation of OSP cuttings along with the orientation on cultivation practices

- Sept. 10-11, 2013 (Bhadra 25-26, 2070)

2. Councelling visit to the sites

- Jan. 12-13, 2014 (Push 28-29, 2070)

3. Harvesting, training and FAT

- Feb. 25- Mar. 1, 2014 (Falgun 13-18, 2070)

1. Plantation and Orientation

Orientation to the farmers about importance of OSP and plantation techniques



Land preparations



Fertilizer application



Planting of OSP cuttings



Irrigating the transplants



2. Counselling visit to the sites

OSP plots in Rupandehi district



Japanese Red sweet potato planted on Chitrlekha Chaudhary's pond dike



CIP 440021 orange sweet potato planted on R. Chaudhary's pond dike

OSP plots in Nawalparasi district



CIP 440267 orange sweet potato
planted on Shova Regmi's pond dike



CIP 440185 orange sweet potato
planted on DR Chaudhary's pond dike

3. Harvesting of OSP and Conducting farmers training

OSP plots harvesting



Training on OSP cultivation technology



FAT with organoleptic testing



RESULTS

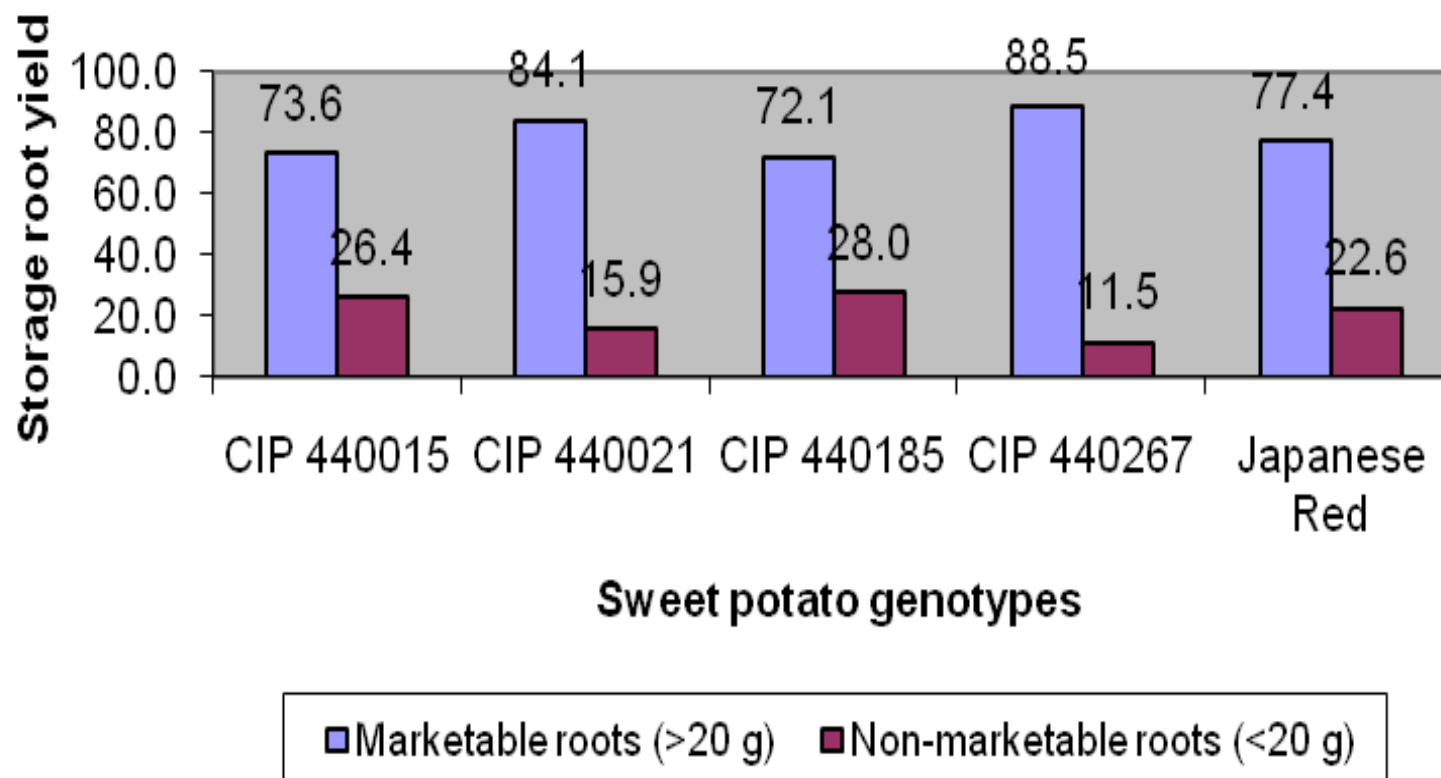
Table 1. Yield performance of sweet potato genotypes planted on fish pond dikes of Rupandehi and Nawalparasi districts

SP Genotypes	Mean root size (g)	Yield (g/pt)	Yield (t/ha)
CIP 440015	47.4 ^{b†}	209 ^b	11.6 ^b
CIP 440021	88.7 ^{ab}	<u>908</u> ^a	<u>50.5</u> ^a
CIP 440185	72.4 ^{ab}	381 ^{ab}	21.2 ^{ab}
CIP 440267	<u>94.2</u> ^a	292 ^{ab}	16.2 ^b
Japanese Red	64.5 ^{ab}	298 ^{ab}	16.5 ^{ab}
LSD _{0.05}	46.14	616.3	34.24

† Figure followed by the same letter within the columns are significantly different at 5% level of significance.

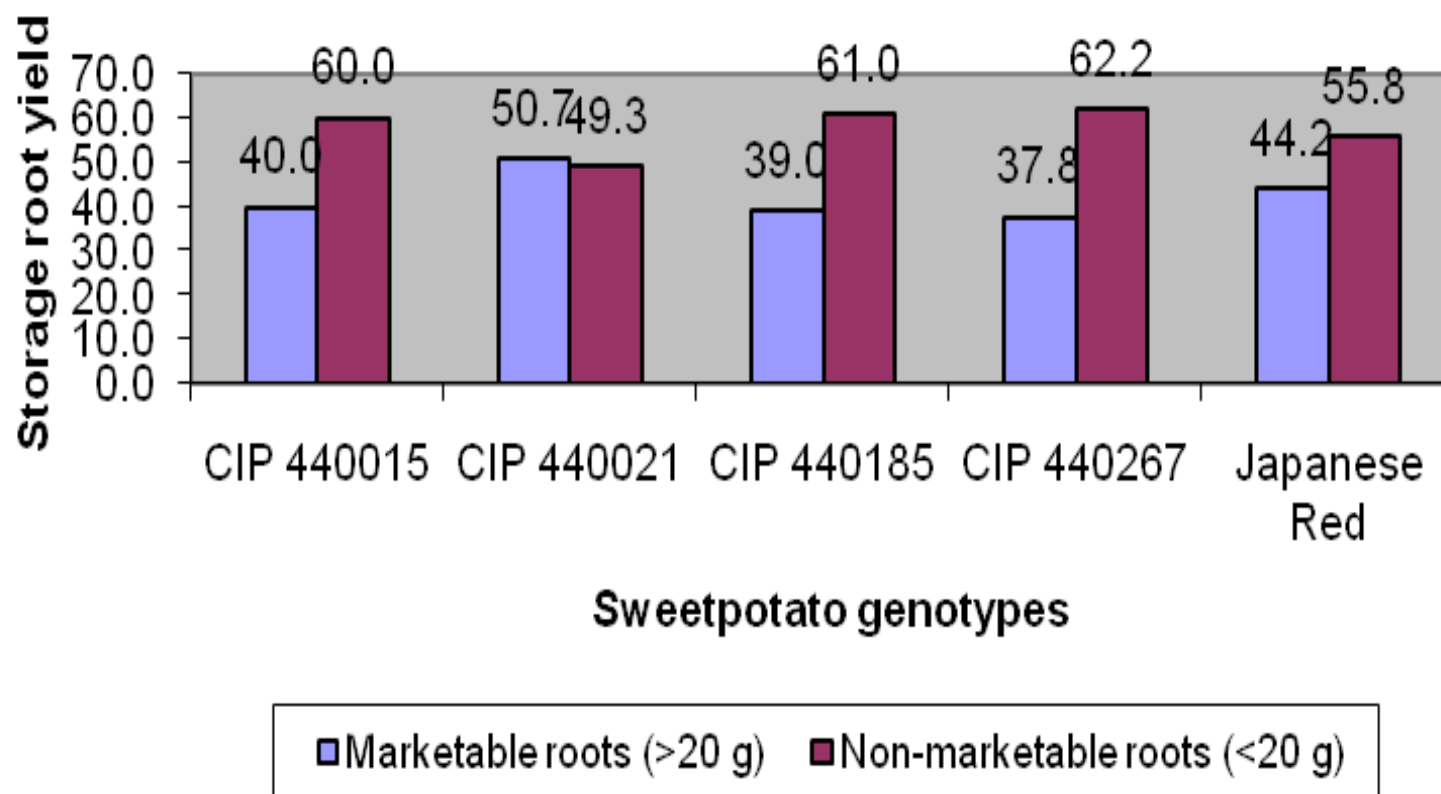
RESULTS

**Fig. 2: Size distribution of storage root yield
(% wt.)**



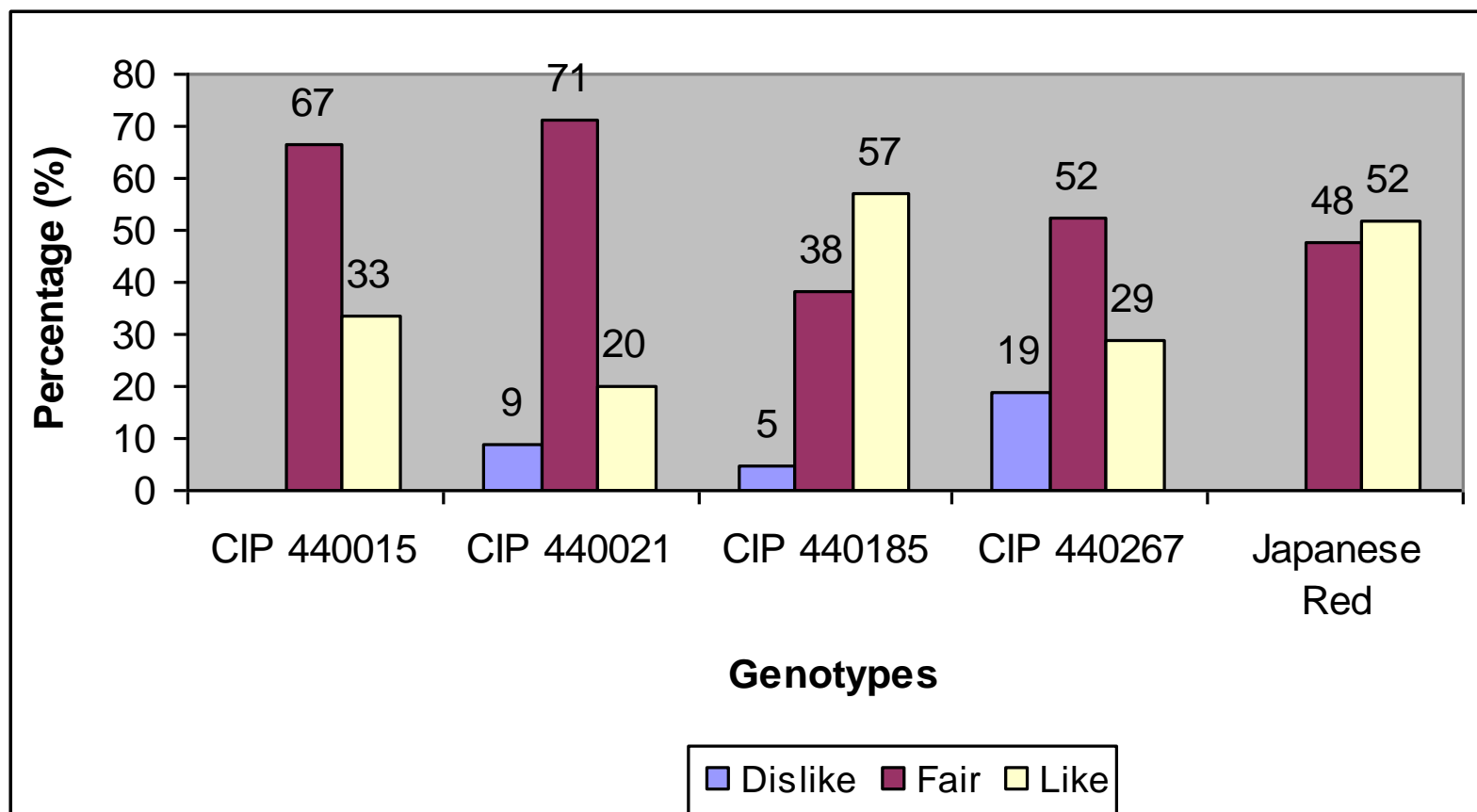
RESULTS

Fig. 1: Size distribution of storage root yield
(% No.)



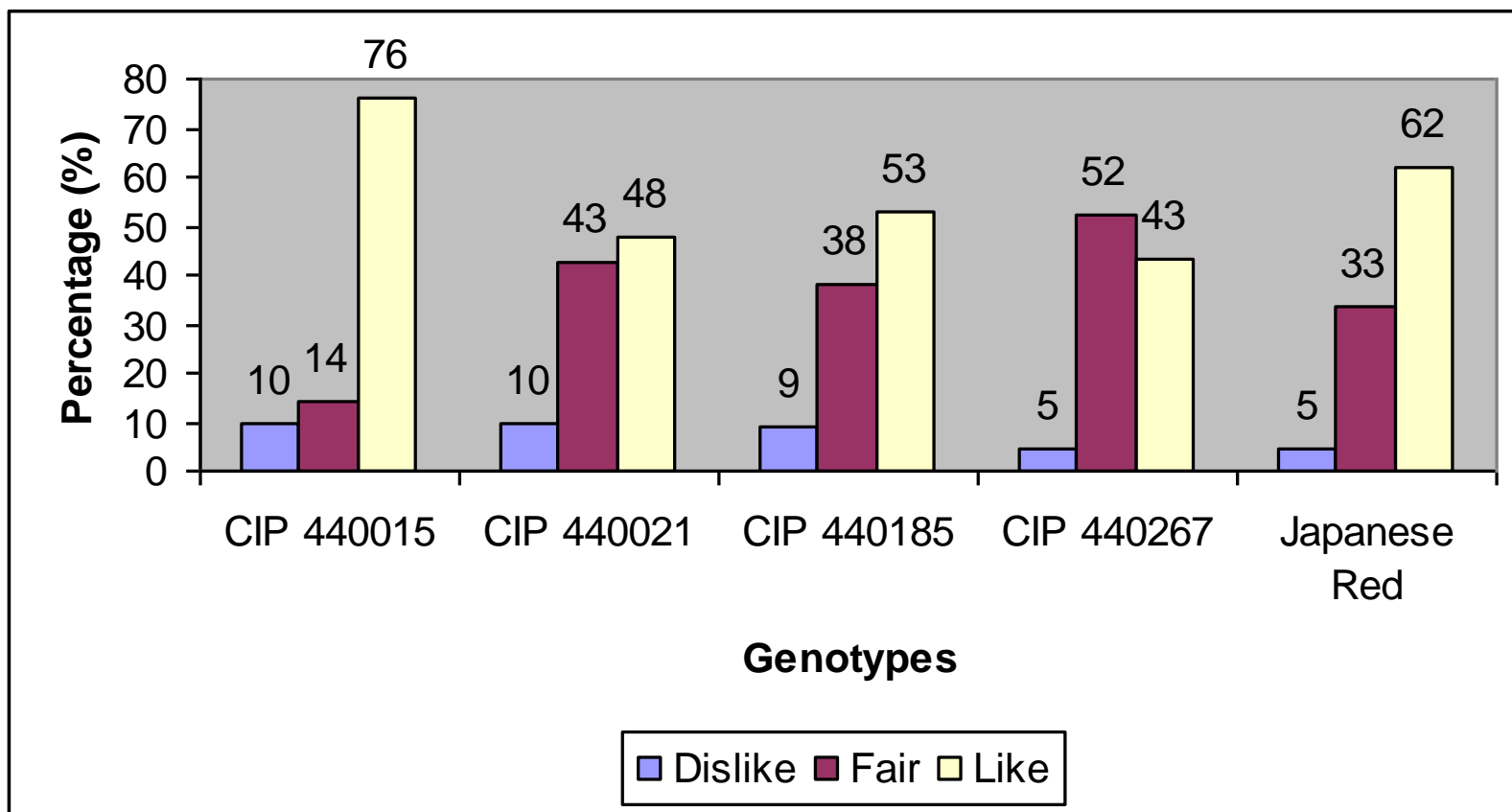
RESULTS

Fig. 3: Appearance of sweet potato storage roots as evaluated by the farmers



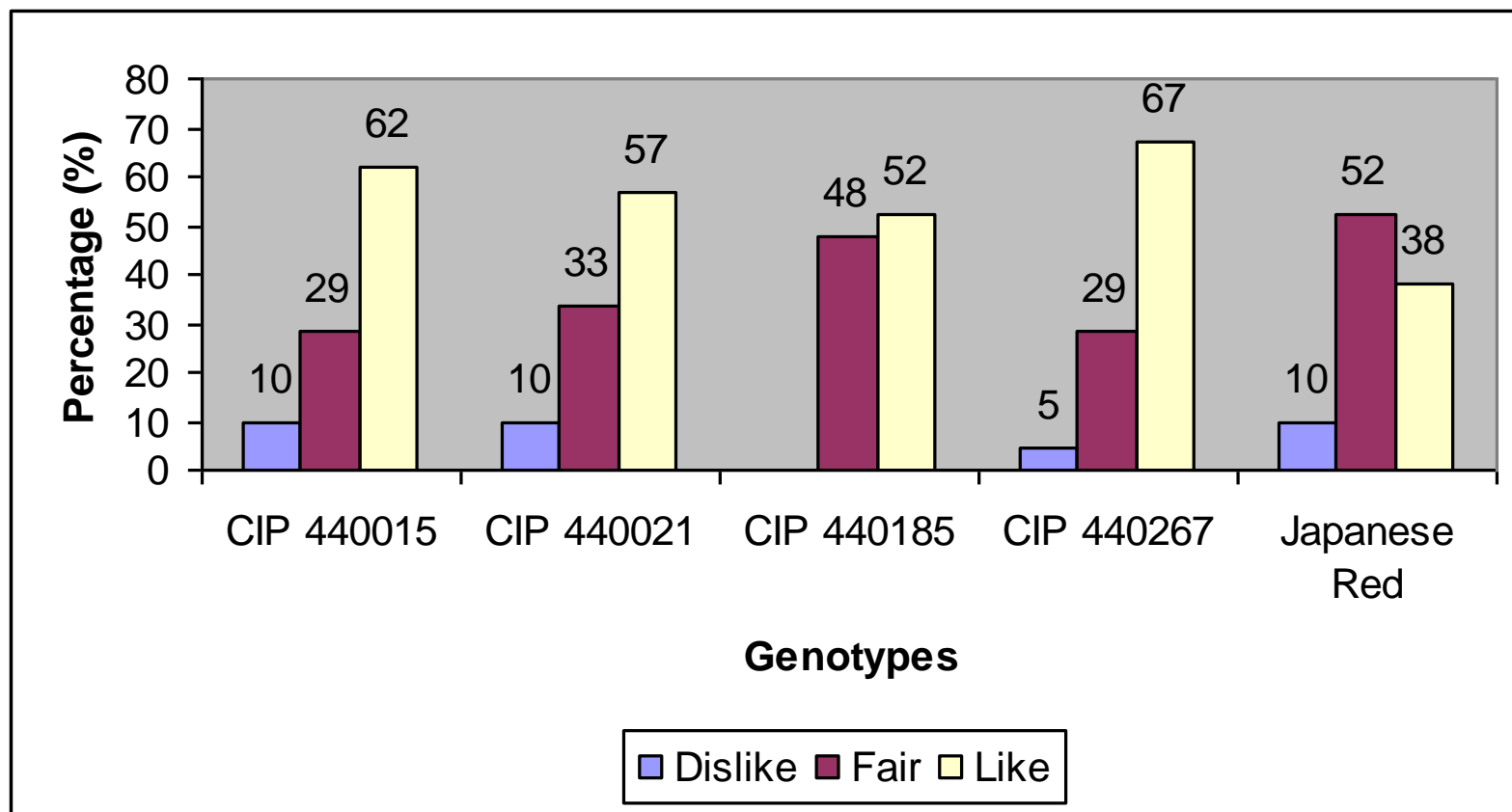
RESULTS

Fig. 4: Skin color of sweet potato storage roots as evaluated by the farmers



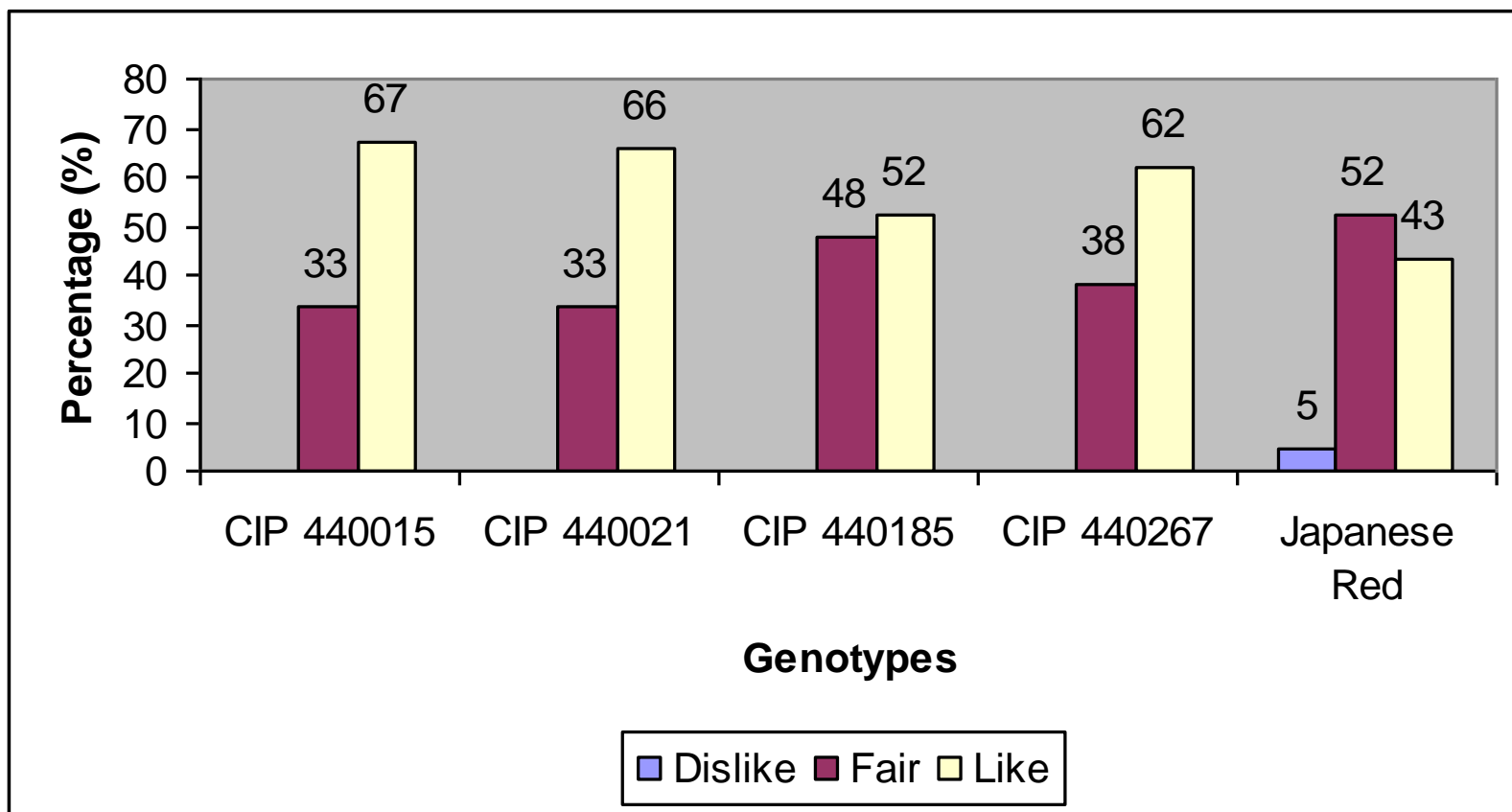
RESULTS

Fig. 5: Flesh color (raw) of sweet potato storage roots as evaluated by the farmers



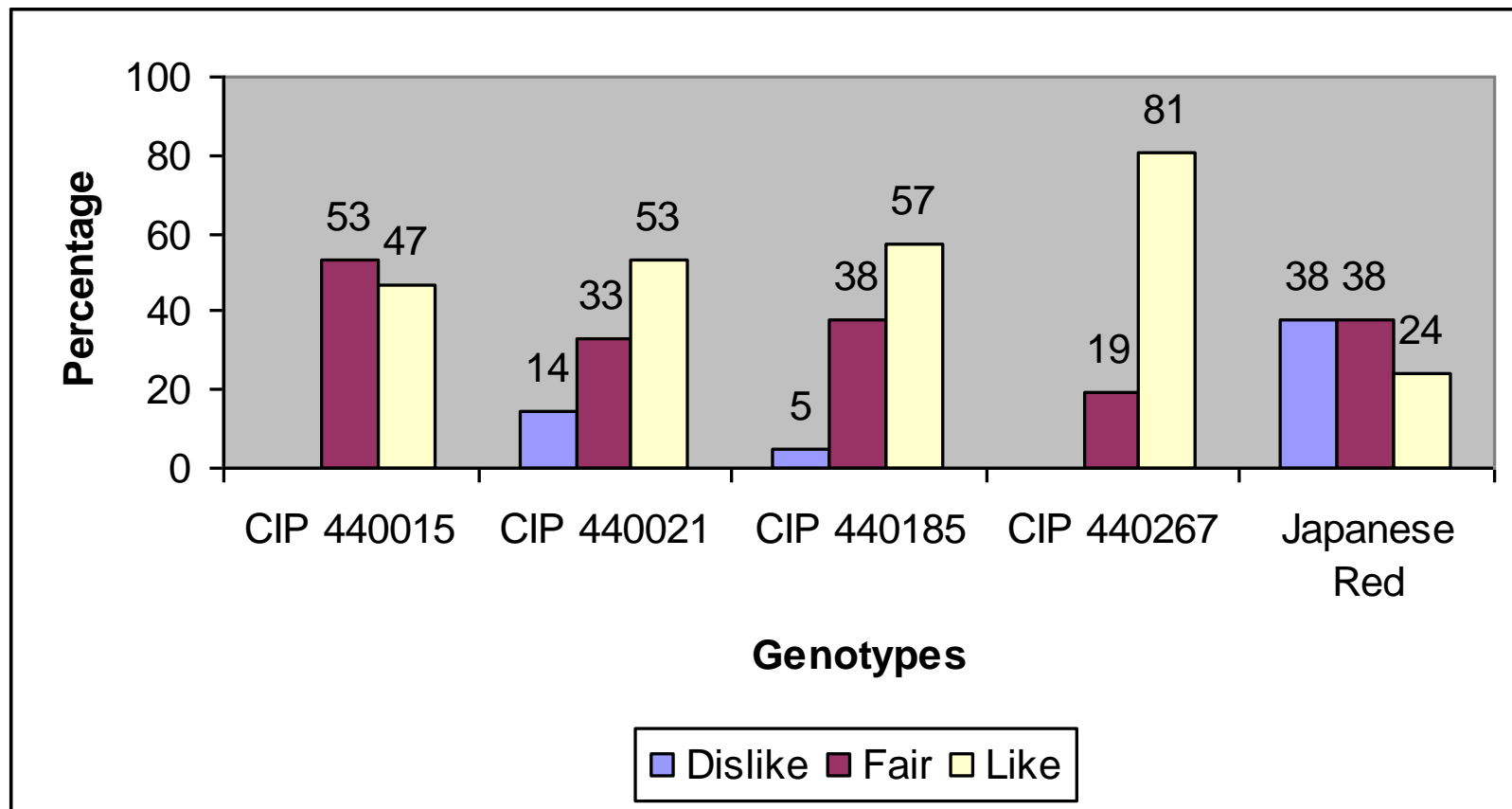
RESULTS AND DISCUSSION

Fig. 6: Flesh color (cooked) of sweet potato storage roots as evaluated by the farmers



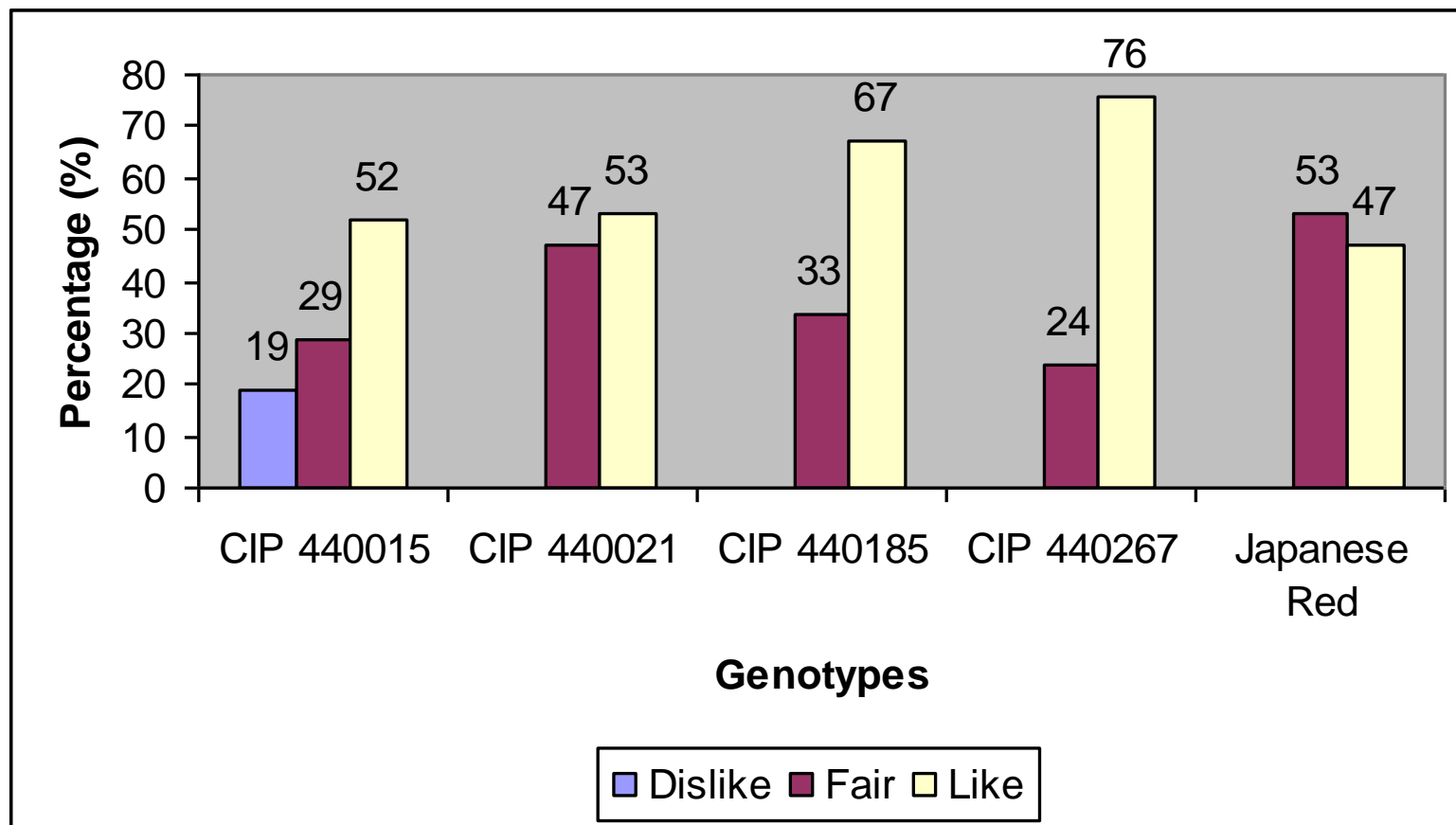
RESULTS AND DISCUSSION

Fig. 7: Raw taste of sweet potato storage roots as evaluated by the farmers



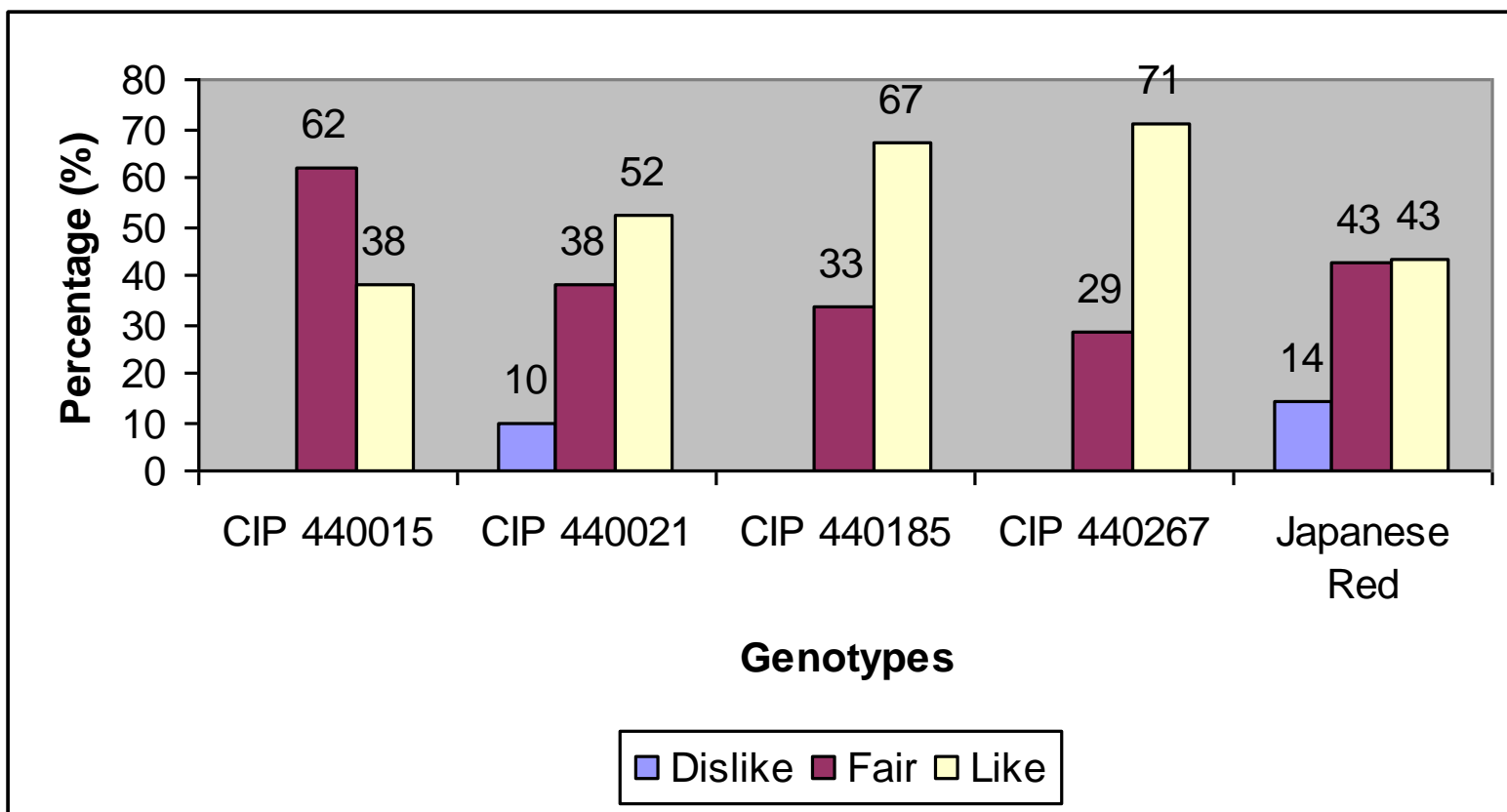
RESULTS AND DISCUSSION

Fig. 8: Cooked taste of sweet potato storage roots as evaluated by the farmers



RESULTS AND DISCUSSION

Fig. 9: Cooked texture of sweet potato storage roots as evaluated by the farmers



CONCLUSIONS

- **Harvesting of sweet potato plants about six months after planting revealed that CIP 440021 yielded highest marketable storage roots (50 t/ha, $P < 0.001$).**
- **Appearance of CIP 440185 (57%), skin color of CIP 440015 (77%), raw flesh color of CIP 440267 (67%), and cooked flesh color of all orange sweet potatoes (>52%) were liked by most of the farmers.**
- **Raw taste of CIP 440267 was highly appreciated (81%) followed by CIP 440185 (57%) and CIP 440021 (53%), following the similar trend in cooked taste and texture.**
- **Based on these findings, CIP 440021 and CIP 440267 were recommended for the cultivation in the fish pond dikes of Rupandehi and Nawalparasi districts.**

Neglected Crop to Golden Crop

High yielding and adopted OSP genotypes identified

Small fish farmers' household production of OSP will be increased

Dietary intake of nutritious OSP by women and young children will be enhanced

R & D institutions should promote OSP throughout the country

ACKNOWLEDGEMENT

Action Research: "Small-scale aquaculture technologies to enhance fish production in Nepal"

Activity: Integrated agriculture-aquaculture (IAA) system.



THANK YOU



Constituents of the Sweetpotato: Values per 100 g Edible Portion

Constituents	Units	Raw sweet potato	Cooked, baked in skin	Cooked, boiled without skin
Water	g	72.84	72.84	72.84
Energy	kcal	105	103	105
	kJ	439	431	439
Protein	g	1.65	1.72	1.65
Total lipid(fat)	g	0.30	0.11	0.30
Carbohydrate by difference	g	24.28	24.27	24.28
Fiber, total dietary	g	3.0	3.0	1.8
Ash	g	0.95	1.06	0.95
Vitamin A, IU	IU	20,063	21,822	17,054
Vitamin A, RE	mcg-RE	2,006	2,182	1,705

Source: USDA, Agriculture Research Service, 2001