

# The Use of Golden Rice Strain for Dealing with Vitamin A Deficit in Hóa Thượng Commune, Đồng Hỷ, Thái Nguyên

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At present, the percentage of persons suffering from the vitamin A deficit in Vietnam is still high. Many measures have been taken to deal with this problem but they didn't produce intended result because we found no optimal solution. In an effort to work out a long lasting and cheap solution to the shortage, the scientific community discovered the golden rice strain.

This strain is produced by adding beta-carotene to the embryo of the local rice strain. However, this strain hasn't been available yet and researches on this strain are still under way, therefore we can only calculate socioeconomic effects that this strain may produce. This paper aims at (1) working out costs of vitamin A deficit; (2) estimating potentials of the golden rice strain; and (3) suggesting measures to produce and use this strain in the surveyed commune.

## 1. Vitamin A deficit in Hóa Thượng Commune

A survey of blood test for under-fives and feeding mothers in this Commune shows that some 20% of them suffered from the vitamin A deficit while most pregnant women show almost no sign of shortage. This means that those two groups must be provided with better nourishment.

## 2. Loss of time caused by the vitamin A deficit in Hóa Thượng before the golden rice strain

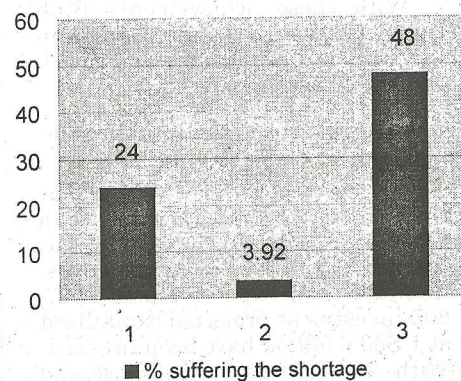
To work out the loss of time caused by the vitamin A deficit (death or period of hospitalization), we use the DALY lost formula introduced by WHO and WB:

Table 1: DALYs caused by vitamin A deficit in Hóa Thượng, Đồng Hỷ District

Item	Under-fives	Pregnant women	Feeding mothers	Total
Total (person)	592	164	396	1,152
%VAD (%)	24	3.92	48	
<b>YLL<sub>death</sub></b>				
Death rate by VAD (% <sub>xx</sub> ) (M=PAR)	0.15	0.0285	0.26	
r (%)	0.1	0.1	0.1	
Life expectancy (L) (year)	55	40	40	
YLL (year)	0.08845	0.00459	0.10111	0.19415
Converted into US\$	88.45	4.59	101.11	194.15 <sup>(*)</sup>
<b>YLD<sub>acute</sub></b>				
RR <sub>acute</sub> (%)	1.19	1.19	1.19	
PAR <sub>acute</sub> (%) = I <sub>ij</sub>	0.0436	0.0074	0.0835	
D <sub>ij</sub> (% <sub>xxx</sub> )	390	95	95	
d <sub>ij</sub> (day)	15	15	15	
r (%)	0.1	0.1	0.1	
YLD <sub>acute</sub> (year)	0.78216	0.00895	0.24408	1.03519
Converted into US\$	782.16	8.95	244.08	1,035.19 <sup>(**)</sup>
<b>YLD<sub>chronic</sub></b>				
RR <sub>chronic</sub> (%)	1.19	1.19	1.19	
PAR <sub>chronic</sub> (%) = I <sub>ki</sub>	0.1687	0.0318	0.2799	
D <sub>ki</sub> (% <sub>xxx</sub> )	300	95	95	
L <sub>ij</sub> (year)	55	40	40	
r (%)	0.1	0.1	0.1	
YLD <sub>chronic</sub>	2.98113	0.48652	1.03403	4.50168
Converted into US\$	2,981.13	486.52	1,034.03	4,501.68 <sup>(***)</sup>

Source: Data gathered in April 2003

Figure 1: Vitamin A deficit in Hóa Thượng



$$\text{DALY lost} = \text{YLL} + \text{YLD}_{\text{acute}} + \text{YLD}_{\text{chronic}} \quad (1)$$

The loss of time caused by death, acute and chronic illnesses suffered by children, pregnant women and feeding mothers could be worked out with the following formulas:

$$\begin{aligned} \text{YLL} &= \sum T_j M_j (1/r(1-e^{-rL_j})) \\ \text{YLD}_{\text{acute}} &= \sum_i \sum_j T_j I_{ij} D_{ij} ((1-e^{-rd})/r) \\ \text{YLD}_{\text{chronic}} &= \sum_i \sum_j T_j I_{ij} D_{ij} ((1-e^{-rL_{ij}})/r) \end{aligned}$$

Thus, the vitamin A deficit costs some US\$5,730 annually [by adding (\*), (\*\*) and (\*\*\*) together]. It will be re-

duced if the situation is improved.

## 3. Loss of time in Hóa Thượng after the golden rice strain

a. Estimate of effects caused by the golden rice strain

We assume two cases: (1) there are 1.6 µg of beta-carotene in 100 g of golden rice and the bioconversion index is 12:1 (an improvement of 10%); and (2) there are 3 µg of beta-carotene per 100 g of golden rice and the bioconversion index is 6:1 (an improvement of 20%)

Estimated loss by casualties and diseases relating to the Vitamin A deficit is still large but there is a great difference



in casualties in those two cases. The casualty in the case 1 is greater than in the case 2.

b. Hóa Thượng consumers' acceptance of the golden rice

The survey covers women only and 60.26% of them agreed to use the golden rice to deal with the vitamin A deficit, the rest chose other rice plus food rich in the vitamin A.

There will be a problem if the price of the golden rice is high. If there is no difference in prices of the golden and normal rice, those who are interested in the VAD are ready to

consume. If there is no difference in taste and color of the golden rice, consumers are ready to use, if not, it will take time to change their habits.

c. Potential effects of the golden rice

These effects are calculated by using the DALYs formula after the quality of the rice is improved. The cost before the golden rice is US\$5,730, in the case (1): US\$5,058 and the case (2): US\$4,386. Thus the difference is US\$672 in the case (1) and US\$1,344 in the case (2).

Although the use of the golden rice can't get rid of the vitamin A deficit, it could improve the situation and reduce the social cost.

**Table 2: Beta-carotene content and estimated effects of the golden rice**

	Case 1: 1.6 µg and bioconversion of 10%			Case 2: 3 µg and bioconversion of 20%		
	1*	2*	3*	1*	2*	3*
Rice consumed (g/day)	300.00	500.00	700.00	300.00	500.00	700.00
CVA (µg /day)	234.30	597.10	404.10	234.30	597.10	404.10
RDA (µg /day)	500.00	800.00	1,250.00	500.00	800.00	1,250.00
VA deficit (µg /day)	265.70	202.90	845.90	265.70	202.90	845.90
β-caroten through GR (µg/day)	480.00	800.00	1,120.00	900.00	1,500.00	2,100.00
VA from GR after bioconversion (µg)	30.00	50.00	70.00	60.00	100.00	140.00
IVA (µg /day)	264.30	647.10	474.10	294.30	697.10	544.10
GR reducing VAD (%)	11.29	24.64	8.28	22.58	49.29	16.55
E(x) (%)	13.96	25.42	12.56	27.05	50.32	23.87

1\*: under-fives. 2\*: pregnant women. 3\*: feeding mothers.

Source: Data gathered in April 2003

**Table 3: DALYs lost after the golden rice**

	Case 1: 1.6 microgram and bioconversion of 10%			
	Under-fives	Pregnant women	Feeding mothers	Total
YLL (\$US)	78.46	3.46	92.74	174.67
YLD (acute) (\$US)	693.85	6.74	223.88	924.47
YLD(chronic) (\$US)	2,644.53	366.63	948.46	3,959.62
Total loss (\$US)	3,416.84	376.83	1,265.09	5,058.76
	Case 2: 3.0 microgram and bioconversion of 20%			
	Under-fives	Pregnant women	Feeding mothers	Total
YLL(\$US)	68.48	2.33	84.38	155.18
YLD (acute) (\$US)	605.53	4.54	203.68	813.76
YLD (chronic) (\$US)	2,307.94	246.74	862.89	3,417.57
Total loss (\$US)	2,981.95	253.60	1,150.95	4,386.50

Source: Data gathered in April 2003

**Table 4: Potantial effects of the golden rice**

	Case 1: 1.6 microgram and bioconversion of 10%			
	Under-fives	Pregnant women	Feeding mothers	Total
GR reducing VAD (%)	11.29	24.64	8.28	
Benefit from reduction in death rate(\$US)	9.99	1.13	8.37	19.48
Benefit from reduction in acute diseases (\$US)	88.31	2.21	20.20	110.72
Benefit from reduction in chronic diseases (\$US)	336.60	119.89	85.57	542.06
Total benefit (\$US)	434.90	123.23	114.13	672.26
	Case 2: 3.0 microgram and bioconversion of 20%			
	Under-fives	Pregnant women	Feeding mothers	Total
GR reducing VAD (%)	22.58	49.29	16.55	
Benefit from reduction in death rate(\$US)	19.97	2.26	16.73	38.97
Benefit from reduction in acute diseases (\$US)	176.63	4.41	40.40	221.43
Benefit from reduction in chronic diseases (\$US)	673.19	239.78	171.14	1,084.11
Total benefit (\$US)	869.79	246.46	228.27	1,344.52

Source: Data gathered in April 2003

#### 4. Conclusions and suggestions

The failure to meet the demand for vitamin A leads to various diseases and increases in the social cost. In a poor commune in the North, the annual loss caused by the VAD could top the US\$5,000-mark. To provide local residents with better and more diverse meals thus becomes a must.

To deal with the VAD, various measures must be taken when researches on the golden rice haven't been publicized:

- Encouraging mothers to regularly take their children to the commune health station for vitamin A.

- Ensuring the food safety for every family and commune.

- Disseminating and promoting initial medical care programs.

- Carrying out researches on programs to supply micronutrients, such as iron and zinc to commune in mountainous areas and to improve strains of plants and animals (the introduction of the golden rice strain will be very useful to those two programs.)■