Tb39 **TOWARDS ABSORPTION AND ENHANCED IRON ACCUMULATION IN RICE ENDOSPERM.** SK Datta (1), M de Vasconcelos (1,2), MD Khalekuzzaman (1,3), N Oliva (1) and K Datta (1). (1) Plant Breeding, Genetics, and Biochemistry Division, International Rice Research Institute, DAPO Box 7777, Metro Manila, Philippines; (2) USDA-ARS SPA, Children's Nutrition Research Center, 1100 Bates Street, Houston, TX 77030-2600, USA; (3) Department of Botany, Rajshahi University, Rajshahi 6205, Bangladesh.

Iron deficiency is the most common nutritional problem in the world. The micronutrient concentrations in edible plant sources, such as rice, are often not enough to provide the recommended daily dietary allowances. Extensive screening is in progress to identify rice germplasm containing higher levels of iron and zinc under the HarvestPlus program. Some lines have already been identified that have potential levels of iron for use in breeding programs. However, after milling, the iron content of the rice grain declines dramatically to almost negligible values. For increasing the iron storage in the rice endosperm, we introduced the soybean ferritin gene driven by an endosperm-specific promoter, GluB-1 into an elite IRRI bred indica rice and also in a popular Bangladeshi rice, BR29. All transgenic plants accumulated higher concentrations of iron and zinc in the grains, reaching as much as 12-22 µg/g iron and 55.5 µg/g zinc in transgenic seeds after polishing as compared to control seeds with 3-10 µg/g iron and 33.1 µg/g zinc. Immunoblot analysis showed the expression of ferritin protein (28-kDa) in the endosperm. Immunolocalization study revealed the higher deposition and distribution of iron in the endosperm tissues. Iron-deficient soils are widespread worldwide and account for about 30% of the world's arable land. Young rice plants are severely affected by the lack of sufficient iron in the soil. The ferric chelate reductase enzyme in the roots of dicotyledonous plants has a major role in increased iron absorption from iron-deficient soils. Experiments are now being carried out to study the uptake, transport, and translocation of iron in those transgenic plants.

Tb40 **BIOFORTIFIED RICE IMPROVES THE IRON STATUS OF IRON DEFICIENT WOMEN.** LF Murray-Kolb(1), JL Beard(1), JD Haas(2), A Felix(3), A del Mundo(3), G Gregorio(4). (1)Dept. of Nutritional Sciences, The Pennsylvania State University, University Park, PA, USA; (2)Division of Nutritional Sciences, Cornell University, Ithaca, NY, USA; (3)University of the Philippines, Los Banos, Philippines; (4)IRRI, Los Banos, Philippines.

Background: A sustainable solution to dietary iron deficiency is needed to significantly reduce the worldwide prevalence of iron deficiency. Most programs to date have focused on supplementation and/or fortification. However, food supplementation programs are relatively expensive, noncompliance can be high, and interactions between supplements and endogenous food components are complex. Fortification programs can be highly effective but again require an infrastructure for delivery and perhaps some targeting. Using plant-breeding to increase the micronutrient density of staple crops may prove to be a major step toward alleviating iron deficiency worldwide. **Aims**: To determine if additional iron, contained in biofortified rice, would result in an improvement in iron status of young adult women under controlled conditions. **Methods**: This was a double-blind, longitudinal (9 mos.), controlled intervention study. Religious sisters were recruited from convents in and around Manila, The Philippines and were randomly assigned to receive either an iron enhanced rice (IR68144; 3.2 ppm Fe wet weight) or a commercially available variety of rice (C4; 0.6 ppm Fe wet weight). Sisters consumed their assigned rice at every meal for the entire 9 mos. Consumption of rice intake was determined on a daily basis by weighing. Weighed food intakes of the entire diet were also collected on 3 days every 2 weeks. Blood samples were collected at baseline, midpoint, and endpoint and used for the determination of ferritin (ft), transferrin receptor (TfR), iron, total iron binding capacity (TIBC), transferrin saturation (TSAT), body iron, and CBC. **Results**: As far as iron intake, the IR68144 rice provided an additional 1.4 mg of iron/d which represented a 10% increase in iron intake in the diets of the women consuming this rice (usual intake is 8-9 mg/d). As far as iron status, those women who were initially the most iron deficient (but not anemic) and who consumed the IR68144 experienced a significant increase in ft as well as body iron over time. This was not seen in the women consuming the C4 rice. **Conclusions**: We have shown that biofortified rice not only contributes to an increase in daily iron intake but that the iron is also bioavailable as evidenced by the significant increase in ft and body iron in women who were initially iron depleted but not anemic.

Tb41 **REGULAR CONSUMPTION OF COMPLEMENTARY FOODS FORTIFIED WITH MICRONUTRIENTS IMPROVES IRON STATUS OF VIETNAMESE INFANTS.** J Berger (1), PV Phu (2), B Salvignol (3), NV Hoan (3), NC Khan (4), PD Tuong (2), S Treche (1). (1) Institut de Recherche pour le Développement (IRD), France; (2) Hanoi Medical University, Vietnam; (3) Groupe de Recherche et d'Echanges Technologiques (GRET) France; (4) National Institute of Nutrition (NIN).

Background: In Vietnam, infants suffer from simultaneous micronutrient deficiencies. **Objective**: To investigate whether regular consumption of complementary foods fortified with micronutrients can improve the iron status of infants. **Design**: a blind controlled trial in Quang Nam province, Vietnam. 21 villages were randomly divided into a control group (C) and two groups receiving either an instant flour (FF) or a food complement (FC) fortified with micronutrients (vitamin A, B1, B2, B3, B5, B12, C, D, Fe, Zn, I, Mg, K). 5 mo. old breastfed infants were included in the study and groups FF and FC received daily for 6 mo at least two meals with the fortified complementary foods. Iron status was assessed by measuring hemoglobin (Hb), serum ferritin (SF) and transferrin receptor (TfR) in venous blood samples. **Results**: at baseline there were no significant differences between the three groups in Hb, SF, TfR. After 6 mo. iron status was significantly better in Group FF (n=120) and in Group FC (n=106) as compared with Group C (n=123). Hb was significantly higher in Group FF (112.5 ± 8.0 g/L) and in group FC (114.0 ± 7.0 g/L) compared to Group C (109.0 ± 8.0 g/L, p=0.0004). Prevalence of anemia had decreased by 28.3% in Group FF and 43.4% in Group FC more than in Group C (9.8%, p=0.03). SF was significantly higher in FF Group (19.8 mcg/L, [17.5-22.3] and in Group FC (20.8 mcg/L [18.3-23.6]) compared to Group C (11.1 mcg/L [9.8-12.5], p<0.0001). The prevalence of SF<12 mcg/L had decreased by 18.3% in Group FF and 7.7% in Group FC whereas it had increased by 27.6% in Group C. Prevalence of TfR >8.5 mg/L had decreased by 1.7 and 0.9 % in Groups FF and FC and had increased by 2.5% in Group C. **Conclusions**: The regular consumption of micronutrient fortified complementary foods significantly improved iron status and decreased the prevalence of anemia and iron deficiency in infants in rural Vietnam (Supported by the French cooperation and the French committee for Unicef).

Tb42 **IRON AND VITAMIN A CONTENT OF FORTIFIED FLOUR IN SELECTED FLOURMILLS IN THE PHILIPPINES.** FS Solon, LS Fermin, AA Bolima, CF Pastores, HC Maglalang. Nutrition Center of the Philippines, Metro Manila, Philippines and Micronutrient Operations Strategies and Techniques Project-USAID, Manila, Philippines.

Background: The Flour Fortification Program was developed under the Philippine Food Fortification Strategic Plan 2000-2004 to address both vitamin A (VA) and iron deficiencies through double fortification of flour with VA and iron. **Aims**: This project aimed to monitor flour fortification test run in 11 of 15 flourmills in the country in preparation for the implementation of the Food Fortification Law and to identify technical problems encountered during the fortification process and recommend solutions to improve the quality of the fortified flour produced. **Methods**: Plant visits were made in 11 out of the 15 flourmills in the country. Flour was fortified with hydrogen-reduced iron at 60 ppm and retinol palmitate Type 250 SD at 490 µg RE/ 100g flour. Iron content of the fortified flour was assessed using Atomic Absorption Spectrophotometry and VA content was assessed using High Performance Liquid Chromatography. The coefficient of variation was used to determine homogeneity of the mix. Sensory evaluation of flour was done using the triangle test. Bread baked from fortified and non-fortified flour was scored. **Results**: Five of the 11 flourmills met the recommended fortification level for iron. Of them, only 3 achieved homogenous mixing. Six flourmills did not meet the recommended iron fortification level but 3 of them were able to produce a homogenous mix. Only 4 of the 11 mills fortified flour with VA. Of them, 2 met the recommended VA fortification level. Only 2 mills met the recommended fortification levels for both VA and iron but only 1 of the 2 mills produced a homogenous mix. The sensory evaluation indicated that the fortification did not produce any unnecessary changes in the color and odor of the flour. Bread score results however, showed varying results for fortified and non-fortified samples among the mills in terms of the physical properties of the bread. **Conclusion**: The monitoring of flour fortification test run has ascertained the need for a standardized flour fortification procedure due to several critical technical problems identified. Further, the need for periodic quality assurance and control is recognized for a more effective and sustainable flour fortification program. (Funding provided by MOST-USAID).