Manual of soil fertility improvement technologies in lowland rice ecologies of Ghana

The impact of fertilizer application on crop production in Sub-Saharan Africa (SSA) is considered enormous as the region is very low in soil fertility. However, access to chemical fertilizers is difficult especially for small-scale SSA farmers who do not have sufficient financial resources in a market-oriented economy. This crucial issue underscores the urgent need for the farmers to increase agricultural productivity, which can be achieved through inexpensive and cost-effective techniques of improving soil fertility in rural areas.

With financial support from the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan, JIRCAS carried out a study on technology development for improved soil fertility using indigenous resources that are accessible and acceptable to local farmers. The study, with rice being the target crop, is aimed at contributing to the goal of the Coalition for African Rice Development (CARD) to double rice production in SSA by 2018. Ghana was selected as the country of implementation because it has two major rice ecologies (rainfed lowland and irrigated lowland) and has good research counterpart institutions.

As one of the products of the study, a technical handbook, titled “Manual of soil fertility improvement technologies in lowland rice ecologies of Ghana,” was published. Written in English, this manual would greatly benefit extension workers and assist them in disseminating the technologies to rice farmers. A summary of the manual’s features is listed below.

1. The manual describes the application of indigenous organic matter as well as their composting and charring technologies, the application of phosphate rocks from neighboring Burkina Faso and its solubilizing technologies, and the enhancement of early rice growth using a minimum quantity of chemical fertilizer (Table 1).
2. The technologies mentioned in the manual were developed in consideration of available materials in each rice ecology and corresponding region. The technologies were evaluated for effectiveness and affordability to the rural communities in on-farm participatory studies.
3. Government officers as well as counterpart researchers in Ghana were actively involved in the editorial process, enhancing their sense of ownership of the manual and technologies. The foreword was written by the deputy minister of the Food and Agriculture (MoFA), Ghana.
4. This manual is compact enough to be carried around. It is printed on A5 size paper and contains only 44 pages, with visually descriptive text and plenty of visuals (photographs and illustrations).
5. The technologies adopted in the manual may be extended to other SSA countries having the same rice ecologies.

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Table 1. Technology options adopted in the soil fertility manual

Options	Rice ecology (Agro-ecological zone)	
	Rainfed lowland (Guinea Savannah zone)	**Irrigated lowland (Equatorial Forest zone)**
Organic matter application	Rice straw base ❖ Direct application or composting ❖ If applicable, small quantity of chemical fertilizer shall be recommended.	Poultry manure base ❖ Prompt effect by direct application ❖ Direct application of rice straw and sawdust causes N starvation in this ecology.
Composting	Cow dung + rice straw ❖ Not acceptable to some farmers	Poultry manure + sawdust/rice straw ❖ Utilization of waste resources
Charring (Kuntan)	Soil physical/biological improvement, no direct effect on soil fertility improvement	
	Rice husks as material	Sawdust as material
Phosphate rock application	Phosphate rocks may appear in the Ghana market in the near future, depending on decision by stakeholders and policy-makers in Ghana. This option is applicable in neighboring PR-producing countries.	
	Direct application ❖ Very effective in all areas in the first year of application. Residual effects differed among fields.	Direct application ❖ Very effective in all areas in the first year of application, as well as having residual effects for at least 3 years.
	Burkina Faso PR is fine powder in texture, thus the spreading method, like mixing with mud, shall be considered.	
Dual application of organic matter and phosphate rock	Optimization of quantity and timing of application ❖ Rice straw shall be incorporated into soil just after harvesting to have better C/N ratio for the next season and to avoid unnecessary burning. ❖ Phosphate rock shall be applied at sowing or transplanting.	
Pretreatment	Early growth of rice is enhanced by pretreatment with a small quantity of water-soluble P fertilizer	
	Coating of fertilizer with rice seeds ❖ Compatible with direct sowing	Soaking of rice seedlings in fertilizer solution ❖ Compatible with transplanting
Technologies for the enhancement of phosphate rock solubility	Useful in upland environments where the solubility of PR is lower (for growing upland rice or upland crops).	
	(1) Incorporate PR in the composting process to make P-enriched compost	
	(2) Incorporate PR in the charring process, expecting calcination in relatively low temperature, to make P-enriched char	

Fig. 1. Charring of saw dust (Kumasi City)

Fig. 2. Demonstration in an on-farm field (at Ziong Village, a suburb of Tamale City)