BETTER CROPS
WITH PLANT FOOD

Better Crops with Plant Food (BC) magazine is published quarterly (four times each year) by the International Plant Nutrition Institute (IPNI). This publication is unique in many ways, and thus has its own set of style guidelines. Prospective authors of articles for BC are encouraged to follow these suggestions. If there are questions, please contact the Editor at IPNI, or an appropriate IPNI staff member. See the website at: http://bettercrops.org

BACKGROUND

Better Crops with Plant Food is not a peer-reviewed academic journal, nor is it intended as a popularized consumer magazine for the general public. The BC audience includes a diverse cross section of readers involved in agronomic research, education, marketing, production, and related fields. Many BC readers work as crop advisers, in soil and water conservation activities, in university and extension responsibilities, and as industry and dealer representatives. The readership also includes students, educators, and farmers.

The purpose of BC articles is to present information originating from agronomic research in a condensed, interpretive style. Readers with a range of educational backgrounds should be able to quickly comprehend the highlights and understand the significance of the subject matter.

An ideal BC Issue is full of learning opportunities from a mix of (1) interpretive research stories from the field, (2) general review articles explaining agronomic concepts, and (3) illustrative examples built around published research, or even a single figure, table, or photo. BC does not accept advertising, and thus does not offer a rate card or editorial calendar. BC does not encourage or accept articles offered by public relations agencies or freelance authors.

In general, articles should be submitted at least 3 to 4 months ahead of expected publication date. Articles should not be submitted directly to the editorial offices at IPNI headquarters. Instead, manuscripts should originate through communication between IPNI Program Directors and a potential author. After the appropriate IPNI Staff have approved a proposed article topic, both will also review the content before passing the article and related material on to the Editor.

Authors will be given opportunity to verify any edits or other changes to articles during the formatting process. Complete contact information should be provided by the author, including e-mail address.

GUIDELINES

Following are some key points related to BC style.

Abbreviations: Preferred abbreviations for BC articles are listed on a separate document (see Preferred Spellings, Abbreviations, and Their Usage).

Units: This may be considered an unusual style policy, but BC publishes some articles in metric units and some in units commonly used in the USA. In an effort to be "reader friendly", the units used in an individual article should be those common to the region associated with the topic. For example, an article on rice yields in Southeast Asia would use metric units such as kg/ha, while an article on corn yields in Iowa would use units such as bu/A. This publication does not use SI units in articles.

Article Length: In general, about 1,200 words should be adequate for most topics as BC articles, plus accompanying tables, figures, photographs, or other illustrations.

Title: The title should be descriptive, but brief. While sensationalized titles are not appropriate for BC, we suggest that authors try to avoid a title that reads like a dull, dusty label.

Author Information: A byline showing the name(s) of the authors(s) should appear immediately after the title. Given names should be spelled out. Further information about the author(s) should be listed at the end of the article. This should include the title, affiliation, and location of each author. The e-mail address of the corresponding author(s) should be indicated. In some circumstances, the e-mail address of each author may be included.

Synopsis: Each article submitted to BC will include a brief highlight sentence or two that introduces the key purpose of the article.

Take It To The Field Message: Articles extracted from field research should include a brief "Take Home" message that can directly state one or two nutrient management lessons that a farmer or crop adviser can use.

Paragraphs: A series of short, descriptive paragraphs should lead the reader through an explanation of the work, general discussion of experiments and procedures, and implications of results. Note practical applications and possible future developments. Subheadings can be helpful.

Summarize: Wrap up the article in a practical statement. Give the reader a conclusion to remember and use.

Statistics, Numbers, and Rounding: BC does not require extensive presentation of statistics with articles. However, any data presented in tables and figures should be supported with appropriate statistics. Whenever statistics are used, the level of significance should be indicated as $p = 0.05$, $p = 0.01$, etc. Limit significant figures in text, tables, and illustrations depending on the units reported and the accuracy of the measuring method or instrument. *For example, it is appropriate to report soil organic matter as 3% or 3.2%, but not 3.21%. Indicate soil pH as 6.5, not 6.52 or 6.523. Percentage yield increase could be 115%, but not 115.4%. In metrics, grain yield should be 3,145 kg/ha, not 3,145.3 kg/ha; or 3.14 t/ha, not 3.145 t/ha. Soil test results should be rounded to 15 mg/kg or 15 ppm, not 15.3. For example, fertilizer application rates should be 150 kg K_2O/ha, not 150.5.*

Keep in mind that the numerical value of every measurement is only an approximation, and no physical measurement of mass, volume, or other parameter is ever absolutely correct. Reported data should not include more digits than those measured. For example, reporting a mean of 12.345 kg from observations made with a scale that weighs to the nearest hundredth of a kilogram would create false precision.

A value can be rounded off to the appropriate number of significant figures by dropping digits to the right. When the first digit dropped is < 5, the last digit retained should remain unchanged. When the first digit dropped is ≥ 5, the last digit retained should increase by 1 if it is odd or remain unchanged if it is even.

For example, if the above mean of 12.345 kg must be rounded to hundredths of a kilogram, drop the last digit to the right. The first digit dropped will be 5 and the last digit retained remains unchanged because is even. The mean will be 12.34 kg. If rounded to tenths of a kilogram, the next digit dropped will be 4 and – because it is less than 5 – the last digit retained will remain unchanged. Therefore, the rounded-off mean is 12.3 kg.

Numerals: It is a fairly universal style or convention to use numerals where practical to indicate values of units of measure, such as 100 bu or 500 ha. Better Crops with Plant Food style preference is to extend this rule and use numerals instead of spelling out numbers in broader usage.

For example, say 8 bu/A instead of eight bu/A; 9 kg/ha instead of nine kg/ha. This more abbreviated style should be applied to situations such as time (hours, days, months, years, etc). For example, say 4 site-years instead of four site-years; 7 hours instead of seven hours.

However, in many situations the standard style is to spell out numbers from one through nine, then use numerals for 10 and above. For example, four researchers and 12 farmers attended.

Table 3. Soil properties at baseline sampling before treatment implementation in June 2013, and as affected by good agricultural practices without fertilizer nutrients (GAP), and GAP including fertilizer nutrients (GAPN) determined in 2014 and 2015.

	pH	OM	Total N	Bray P	Exch. K	Exch. Mg	Exch. Ca	Ca:Mg ratio	(Ca+Mg):K ratio
		----- % -----		mg/kg	------ meq/100 g ------				
Base 06/2013	5.4	4.4	0.19	40.5	0.68	5.5	26.6	6.8	50.6
GAP 06/2014	7.0	4.0	0.18	43.6 a	0.54	4.3	20.3	5.7	52.5
GAPN 06/2014	7.0	3.9	0.19	28.6 b	0.56	4.8	18.9	4.8	50.3
GAP 12/2015	6.9	4.4	0.18 b	59.0	0.90	3.1 a	15.8	5.2	27.8
GAPN 12/2015	6.8	4.3	0.30 a	78.6	0.69	2.9 b	16.1	5.6	28.4

Notes: June 2013/2014, 22 farms; December 2015, 12 farms; others had applied fertilizer in GAP. Differences within each year between GAP and GAPN were tested for statistical significance. Values without letters are not significantly different from one another within the same year at $p < 0.05$.

Subscripts: Authors should include proper subscripts and superscripts where appropriate for expressions such as P_2O_5 and K_2O. Where the ionic form of an element is used, it should appear with the correct charge indicated, such as NO_3^-, NH_4^+, SO_4^{2-}, Cl^- or Ca^{2+}.

Currencies: When necessary to indicate that a monetary value is presented in a specific currency, use the full abbreviation of a currency on its first appearance (e.g. A$52, C$52, US$52); subsequent occurrences can use just the symbol of the currency (e.g. $88), unless this would be unclear. When there are different currencies using the same symbol in an article, use the full abbreviation (e.g. US$ for the US dollar and A$ for the Australian dollar, rather than just $).

Do not place a currency symbol after the value (e.g. 123$, 123£, 123€). Currency abbreviations that come before the number are unspaced if they consist of or end in a symbol (£123, €123), and spaced if alphabetic (R 75).

Format ranges with one, rather than two, currency signifiers (e.g. $250 to 300, not $250 to $300). A US$ conversion rate for all other currencies will need to be included in the article's list of abbreviations and notes.

If there is no common English abbreviation or symbol, use the ISO 4217 standard (details found at http://en.wikipedia.org/wiki/ISO_4217).

References: While references are allowed with articles for BC, we discourage excessive lists. Also, BC uses an abbreviated style in reference lists, a form of the author-year notation system. For example, in citing a reference from a periodical at the end of the text of a BC article, the title of the article should not be included. If the citation has more than three authors, only the first author is provided followed by the et al. notation. Here are some examples of typical citations:

Bordoli, J.M. and A.P. Mallarino. 1998. Agron. J. 90:27-33. Gerendás, J., et al. 2015. Better Crops. 99(3):11-13.

BC style also limits the number of authors to be named in a reference within the text of an article. Where more than two authors are associated with a reference, BC style is as follows: Name the first author, then use "et al." to indicate that there are additional authors not listed. However, all authors should be named in the reference list at the end of the article (special circumstances may require an exception to be determined by the Editor). Here are some additional guidelines related to references.

1. All publications cited in the text should be presented in a list of references following the text of the manuscript. The manuscript should be carefully checked by the author(s) to ensure that the spelling of names and indication of dates are exactly the same in the text as in the reference list.
2. In the text, refer to the author's name (without initial) and year of publication. Examples: "Since Johnson (1988) has shown that..." "This is in agreement with results obtained later (Welch, 1989)."
3. References cited together in the text should be arranged chronologically. The list of references should be arranged alphabetically by author's names, and chronologically per author. References should not be numbered.
4. Acknowledgments are generally not encouraged with BC articles, but are considered on a case-by-case basis.

EXAMPLE OF BETTER CROPS WITH PLANT FOOD STYLE ELEMENTS GUIDELINES

(see next page for examples)

Region: Indicate the geographic area, such as North America, Brazil, China, etc.

Headline: The title should be concise and descriptive.

Name of author(s): Given names should be spelled out.

Synopsis paragraph: An opening summary statement is required at the beginning of each article.

Photos: Images should be provided as high resolution digital (tif or jpg preferred) files. Provide images as separate file. Images embedded with article text are considered examples only.

Text: State the key information. Avoid complex sentences. Use subheads when appropriate.

If using figures (graphs, charts): Provide figures as separate files in their original forms (Excel, PowerPoint, etc.). You can embed them with the article text as an example of their use only. Include the data used to create graphs when possible and practical.

For major nutrients and frequently used expressions: List abbreviations in a box to reduce the need for parenthetical notes in the article.

Tables: Generally, two or three tables should be sufficient. More may be allowed, but avoid large, complex tables. Tables should be regular text or created with the Word table function. Tables should appear at the end of the file. See further comments about tables with page illustration on the next page.

GUIDELINES FOR TABLES OF DATA IN BC ARTICLES

- Heading should be concise and descriptive.
- Use standard abbreviations in column headings and for units.
- Generally, align data at the decimal point.
- While statistical significance information is not required, it can be included if deemed appropriate.
- Level of significance should be indicated, e.g., $p = 0.05$..

BetterCrops
with plant food

SAMPLE PAGES

PHOTOS

REGION

INDONESIA

HEADLINE

AUTHOR(S)

Cocoa Yield under Good Agricultural Practices and 4R Nutrient Management in Indonesian Smallholder Systems

By Thomas Oberthür, Marianne Samson, Noel Janetski, and Kate Janetski

Cocoa global production has surged strongly over the past 20 years to nearly 4.6 million (M) t, mostly from West Africa (FAO, 2013, 2016). Between 2020 and 2025, consumers' demand for cocoa will increase by 1 M t (ICCO, 2015), mainly driven by the growing consumption in the Asia-Pacific region, particularly China and India (Squicciarini and Swinnen, 2016). Growth in West African production has stagnated over the last 10 years at a level of about 2.7 M t, and continued growth in demand has encouraged new producers into the market. Indonesia is now the world's third largest producer, with a planted area between 0.8 to 1.1 M ha, seemingly well placed to benefit from global market developments.

Until recently, growth of production has been almost entirely through expansion of area. With the exception of Central America, which has shown a steady improvement over the past 20 years, yield in many areas has plateaued at an average close to 0.5 t/ha (Baah et al., 2011; Assiri and Koko, 2009), well below a theoretical potential of 11 t/ha (Corley, 1983). Indonesia is no exception, and since 2010 yield has dipped below 0.5 t/ha, undermining cocoa farm profitability and presenting substantial risks to the survival of the industry in Indonesia. At the same time, global markets are strong. The opportunity for Indonesia is to benefit from growth in global demand by pushing yield consistently beyond 1 t/ha. With adequate management in place, cocoa dry bean yields between 1 and 3 t/ha can be achieved in commercial fields (Ahenkorah, 1997; Butler, 2004; Maharaj et al., 2005; Pang, 2006, Koko et al., 2013). The role

Researchers combined a suite of good agricultural practices with 4R-consistent nutrition to achieve a rapid improvement in cocoa bean yield and quality under the guidance of local Cocoa Carers and Monitors. Close monitoring of the soil nutrient balances will be required to sustain this early gain.

SYNOPSIS

KEYWORDS:
sustainable intensification; cocoa fertilization; dry bean yield; bean size; good agricultural practices

KEYWORDS ABBREVIATIONS AND NOTES

ABBREVIATIONS AND NOTES:
N = nitrogen; P = phosphorus; K = potassium; Mg = magnesium; S = sulfur; Ca = calcium; OM = organic matter; ROI = return on investment.

IPNI Project IDN-27

https://doi.org/10.24047/BC10213

If the article is related to an IPNI project, add the project number at the end.

TAKE IT TO THE FIELD

Directly state a brief lesson that a farmer or crop adviser can use.

TEXT

TABLES

PAGE NUMBER

FIGURES

Do not embed figures(charts, graphs) with the article text when themanuscript is submitted. Provide as separate files.

Legends for a figure axis follow BC Style. For example, use Fertilizer concentration, %, not Fertilizer concentration (%).

AUTHOR INFORMATION

Author information should include affiliation, location, and e-mail address.

TABLES

Guidelines for Tables of Data in BC Articles

- Heading should be concise and descriptive.
- Use standard abbreviations in column headings and for units.
- Generally, align data at the decimal point.
- While statistical significance information is not required, it can be included if deemed appropriate.
- Level of significance should be indicated, such as $p = 0.05$.

REFERENCES

If three of more names are included in a reference, we will condense it to show the first author name only, year of publication, and source. The title of the article will not be included.

TAKE IT TO THE FIELD

Yields above 1,000 kg/ha were common for fertilized farms throughout most of the study and this progress instilled confidence amongst cocoa growers about their investment in fertilizer. Improving agronomic skills is a critical part of shielding this vulnerable group against a loss in their investment, which typically takes place during periods of adverse market or weather conditions.

in year 2. One farmer came close to 3 t/ha in the second year of management change.

Quality of beans is a criterion for sales transactions. Large beans have less shell, hence waste, and typically higher fat content, which may attract price premiums. We used bean count as proxy for size. The industry considers bean counts lower than 100 as very good, and counts above 120 are outside commercial standards. Farms participating in the Cocoa Care/IPNI program recorded bean counts far below 100, with year 2 better than year 1, and GAPN significantly improving on GAP (**Table 2**).

Table 2. The effects of good agricultural practices without fertilizer nutrients (GAP), and GAP including fertilizer nutrients (GAPN) on dry bean yield (t/ha) and bean size of cocoa (as number of beans per sample of 100 g) over a period of two years.

	Dry bean yield, t/ha		Bean size, Number/100 g	
Treatment	Year 1	Year 2	Year 1	Year 2
GAP	0.582	0.790	93.6	73.4
GAPN	0.791	1.169	90.2	69.5
Significance at 5%	***	****	****	****

Notes: 22 farms. Yield was converted to a per ha basis using a tree density of 1,100 trees/ha.

Traditionally, most cocoa in Sulawesi is harvested between June and August. Cash income is restricted to these months, and curtails significantly farmers' ability to invest in farm inputs required during other times of the year. Good agricultural practices induced production in months during which little crop is normally harvested, and adding nutrients further improved the distribution of marketable cocoa beans (**Figure 1**). The typically low period between January and June was remarkably productive. Year 2 data indicate that adding nutrients successively increased the yield gap over

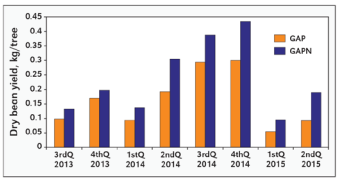

Figure 1. The effects of good agricultural practices without fertilizer nutrients (GAP), and GAP including fertilizer nutrients (GAPN) on dry bean yield distribution over eight quarterly measurement periods. Average values of yield from 22 farms.

good agricultural practices only.

Tables 3 and **4** present the results from the laboratory analyses of soil and tissues samples, respectively. Both GAP and GAPN improved soil pH to an optimal point for cocoa. Soil organic matter dropped somewhat in Year 1, but increased again in Year 2 under both management options. This is likely an effect of regular pruning in all farms. Total soil N remained stable, except for an increase in GAPN in Year 2, which was expected given the optimal supply of external fertilizer N. Soil P and K was considered somewhat low at the start of the program, and fertilizer inputs were designed to increase concentrations, and then maintain them. Decreased exchangeable Mg in Year 2 in both treatments signal that the reduction of fertilizer Mg in that year was an incorrect decision. Year 2 values indicate that high yields under GAPN may have started excessive soil Mg removal that needs correction in the coming years. Higher yields under both treatments will have extracted more Mg than was replaced by fertilizer applications. Calcium was initially high and were acceptable after Year 2. Adequate nutrient management is required to maintain the Ca concentration to ensure that cation balances remain at present ratios to prevent

Table 3. Soil properties at baseline sampling before treatment implementation in June 2013, and as affected by good agricultural practices without fertilizer nutrients (GAP), and GAP including fertilizer nutrients (GAPN) determined in 2014 and 2015.

	pH	OM	Total N	Bray P	Exch. K	Exch. Mg	Exch. Ca	Ca:Mg ratio	(Ca+Mg):K ratio
		----- % -----		mg/kg	------ meq/100 g ------				
Base 06/2013	5.4	4.4	0.19	40.5	0.68	5.5	26.6	6.8	50.6
GAP 06/2014	7.0	4.0	0.18	43.6 a	0.54	4.3	20.3	5.7	52.5
GAPN 06/2014									
GAP 12/2015									
GAPN 12/2015									

Notes: June 2013/201
within each year betw
significantly different f

Table 4. Measured concentration of nutrients in leaf tissue, as affected by good agricultural practices without fertilizer nutrients (GAP), and GAP including fertilizer nutrients (GAPN), at four different sampling dates.

	GAPN	GAP	Difference	Significance[1]
N concentration, %				
December 2013	1.856	1.689	0.171	**
June 2014	1.935	1.916	0.019	ns
December 2014	1.714	1.779	-0.065	ns
December 2015	1.818	1.874	-0.057	ns
P concentration, %				
December 2013	0.136	0.149	-0.012	**
June 2014	0.140	0.141	-0.001	ns
December 2014	0.127	0.126	0.001	ns
December 2015	0.113	0.108	0.005	ns
K concentration, %				
December 2013	1.621	1.644	-0.024	ns
June 2014	0.747	0.738	0.010	ns
December 2014	1.596	1.514	0.082	ns
December 2015	1.482	1.548	-0.066	ns
Mg concentration, %				
December 2013	0.563	0.545	0.018	ns
June 2014	0.215	0.226	-0.011	ns
December 2014	0.447	0.439	0.008	ns
December 2015	0.298	0.258	0.039	ns
Ca concentration, %				
December 2013	2.436	2.402	0.035	ns
June 2014	1.716	1.748	-0.032	ns
December 2014	2.131	2.098	0.033	ns
December 2015	1.220	1.033	0.188	ns

Notes: 22 farms sampled at all dates. [1] ** = significance difference at $p < 0.05$; ns = not significant.

antagonistic uptake effects on K and Mg by Ca.

For the last two sampling dates, leaf tissue concentrations of P, Mg, and Ca were higher in GAPN, and somewhat lower for N and K, compared to GAP. With both management options, a common trend is observed for all monitored nutrients—tissue concentration was highest at the initial sampling dates.

This trend confirms the indications from the soil analyses that higher yields under both management options are removing more nutrients than the soil and fertilizer can currently supply. Nutrient supply in the coming years, from inorganic and organic sources, will have to arrest the downward trend to prevent soil nutrient mining. Given the success of the Cocoa Care extension with Carers, Monitors, and the strong markets, farmers increasingly embrace sustainable intensification, of which responsible use of soil resources is an accepted component. The timely establishment of adequate nutrient supply chains has become critical.

Conclusions

Intensified cocoa smallholder production systems have been established under an extension approach led and driven by highly trained farmers, guided by Cocoa Care. The impact of 4R-consistent nutrient management as part of this approach has been demonstrated with an on-farm trial network. Peer learning between farmers, coupled to strong markets for quality cocoa, is leading to a rapid adoption of improved, intensive management. The fertilizer industry needs to engage in a timely manner with the cocoa sector to ensure accessible and affordable nutrient supply chains prevent soil resource depletion under intensive cocoa production systems. **BC**

Dr. Oberthür (e-mail: toberthur@ipni.net) and Ms. Samson are with IPNI Southeast Asia, Penang, Malaysia. Mr. and Ms. Janetski are with Community Solutions International's Cocoa Care Program, Bali, Indonesia.

References

Ahenkorah, Y. 1997. In Proc. Soil Science. Ghana 14 & 15:21-29.
Assiri, A.A. and K.L. Koko. 2009. 16th International Cocoa Research Conf., Bali, Indonésie.
Baah, F. et al. 2011. Agric. Biol. J. N. Am. 2:173-181.
Butler, D.R. et al. 2004. In Proc. APASTT Seminar—Exhibition, Re-vitalisation of the Trinidad & Tobago Cocoa Industry, pp.39-48 St. Augustine, Trinidad.
Corley, R.H.V. 1983. Experimental Agriculture 19:217-237.
Cunningham, R.K. and P.W. Arnold. 1962. J. Sci. Food Agric. 13:213-221.
FAO Statistics Division. 2013. Viale del Terme di Caracalla, Rome, Italy.
FAO Statistics Division. 2016. Viale del Terme di Caracalla, Rome, Italy.
Ghana Cocoa Board. 2002. Report of the Committee on Application of 'High Technology' Method on Cocoa Production in Ghana. Accra: Ghana Cocoa Board.
ICCO. 2015. Westgate house, Ealing, London, UK.
IPNI. 2012. 4R Plant Nutrition Manual: A manual for improving the management of plant nutrition. (T.W. Bruulsema et al. eds.) IPNI, Norcross, GA, USA.
Koko, L.K. et al. 2013. Agroforest Syst. 87:1043-1052.
Pang, J. T. Y. 2006. Expl. Agric. 42:289–299.
Maharaj, K. et al. 2003. In Proc. International Workshop on Cocoa Breeding for Improved Production Systems (F. Bekele et al. eds.) Accra, Ghana, pp.171-182.
Nelson, P.N. et al. 2010. 19th World Congress of Soil Science, Soil Solutions for a Changing World. 1-6 Aug. 2010, Brisbane, Australia.
Squicciarini, M.P. and J. Swinnen, 2016. *In* The Economics of Chocolate (M.P. Squicciarini and J. Swinnen eds.). Oxford Univ. Press, pp.1-10.
Uribe, A. et al. 2001. Better Crops International. 15(2):3-5.