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UNUSUAL CLIMATE CONDITIONS OF 2010/11 & PEST/DISEASE OUTBREAKS

C. (Kees) J. Stigter, Agromet Vision
(Bondowoso/Depok, Indonesia; Bloemfontein, South Africa; Choma, Zambia; Harare, Zimbabwe; Bruchem, Netherlands)

PART I: <u>CLIMATE AS ENEMY! HOW DO WE FIGHT? WHAT DO WE FIGHT?</u>

Introduction

Vulnerable communities across the world are already feeling the effects of a changing climate. These communities are urgently in need of assistance aimed at building resilience, and at undertaking climate change adaptation efforts as a matter of survival and in order to maintain livelihoods . They are in need of what we want to call an urgent rural response to climate change.

The reality of climate change calls for a need to understand how it might affect a range of natural and social systems, and to identify and evaluate options to respond to these effects. This should lead to in-depth investigation of vulnerabilities and adaptations to climate change, which have become central to climate science, policy and practice. The capacity, however, to conduct vulnerability and adaptation assessments is still limited.

While it is relatively easy to define technical messages that can be communicated, we have to look beyond "adaptation to current climate variability" and target the basic vulnerability factors of communities. Communication also aims at improving the learning process and creates capacity to cope with climate variability. Measuring rainfall and observing the agronomical consequences by farmers in their plots have been a great start for such communications.

Applied scientists should basically be the connection between applied science and the actual production environment. To that end they in fact would be most useful to back up well educated extension intermediaries. The latter must train, on an almost daily basis, farmers, farmer facilitators and ultimately farmer trainers and farmer communities. Unfortunately, extension services are very often virtually absent. Where they still do exist, they are badly trained and have received little or no upgrading about the fast changes that are occurring in the agricultural production environment and about the actual crises in the livelihood of farmers.

El Niño and La Niña

Agricultural production in Indonesia is strongly influenced by the annual cycle of precipitation and the year-to-year variations in the annual cycle of precipitation caused by El Niño-Southern Oscillation (ENSO) dynamics. The combined forces of ENSO and global warming are likely to have dramatic, and currently unforeseen, effects on agriculture production and food security in Indonesia and other tropical countries. To date, climate models have been developed with little knowledge of agricultural systems dynamics. While agricultural policy analysis has been conducted with little knowledge of climate dynamics. Integration proposed will permit an assessment of climate-related uncertainty associated with global warming and ENSO dynamics. It will also demonstrate how the treatment of uncertainty affects the choice and consequences of agricultural policies.

During El Niño events, Indonesia's production of rice, the country's primary food staple, is affected in two important ways: (i) delayed rainfall causes the rice crop to be planted later in the monsoon season, thus extending the ''hungry season'' (*paceklik*, the season of scarcity) before the main rice harvest; and (ii) delayed planting of the main wet-season crop may not be compensated by increased planting later in the crop year, leaving Indonesia with reduced rice area and a larger than normal annual rice deficit. The ENSO actually can swing beyond the "normal" state to a state opposite to that of El Niño, with the trade winds amplified and the eastern Pacific colder than normal. This phenomenon is often referred to as La Niña. In a La Niña year (or better: when a La Niña period occurs), many Asian regions inclined toward drought during an El Niño, such as Indonesia, are instead prone to more rain.

Both El Niños and La Niñas vary in intensity from weak to strong. The intervals at which El Niños return are not exactly regular, but used to vary from two to seven years. Even that is presently no longer true. Sometimes an El Niño subsides into a "normal" pattern. At other times it gives way to a La Niña. In many ways, the ENSO cold phase is simply the opposite of the warm phase. This often holds true also for the climate impacts of the two. El Niño (warm phase) tends to bring drought to countries like Indonesia and Australia, at the west end of the Pacific, while La Niña (cold phase) tends to bring more rain than normal there. Now it appears that the frequency of these phenomena has changed in recent times and also the way in which they follow each other.

However, we are not able to simulate these actual changes with the models that summarize our understanding, that apparently is at this moment still very insufficient.

PART II. ***ACTUAL EVENTS AND THEIR CONSEQUENCES***

Occurrences

Indonesia, during the 1997-98 El Niño drought episode, was ravaged by forest fires. But officials also feared that torrential La Niña rains on Indonesia's charred and devegetated lands could produce flash floods, serious soil erosion, and an ashy brew of runoff toxic enough to kill fish and damage ecosystems. What actually also happened was a serious BPH Outbreak. I will show that there is similarity with what happened in 2010/2011.

At the beginning of a more recent El-Niño period in 2009/10, severe drought indeed delayed the planting season. Farmers applied some adaptation strategies such as practising dry-nursery instead of wet-nursery seedbeds, selecting rice varieties with more suitable lengths of their growing season and building ground-water ponds, which all proved to be beneficial. In the meantime, in March 2010, the El Niño situation made place for a recurring La Niña situation that overtook the prevalent El Niño with an unprecedented speed. But we were not aware of that from any existing forecasts. This situation was worsened by a climate induced Brown Plant Hopper (locally known as *wereng cokelat*) attack. Farmers face ever increasing problems from such extreme events.

Farmer organizations in Indonesia are blaming the local and central governments for being too slow in educating farmers on how to adapt to extreme weather shifts. We should generate and support a rural response to climate change.

Farmers in Indramayu had asked us in March 2010 what we expected to happen. Whether the end of the rainy season could be any better than its disastrous very late start (in December). From the NOAA "ensemble" predictions review, we indicated this to be very unlikely, but that the present developments were quite uncertain. That was of course of little help. Moreover, as appeared in as late as June, the forecasts in these months were all wrong.

Also BMKG (the Indonesian National Weather Service) was completely wrong at the usual end of the main rainy season of 2009/2010. They predicted for some areas an early dry season, between late March and May, with most areas likely to have a normal dry season in June. Only at the end of May it started to warn for heavy rains and to blame these anomalies and unpredictabilities on global warming, while it was a La Niña causing the problems.

We would never have been able to forecast what happened in the usually dry but now abundantly wet “dry” season in Indonesia in 2010, using the NOAA or other available predictions. Farmers remain confused, together with the scholars and the forecasters, in case of such rare fast changes from El-Nino to La Niña. This was even not an extreme condition by itself but an extremely fast change at an extremely odd moment of the usual beginning of the dry season. However, such confusions are happening more and more. It may be expected that such capricious behavior, that may then also develop into still more serious (prolonged and intensified) droughts and floods, will occur more often, together with the related confusions.

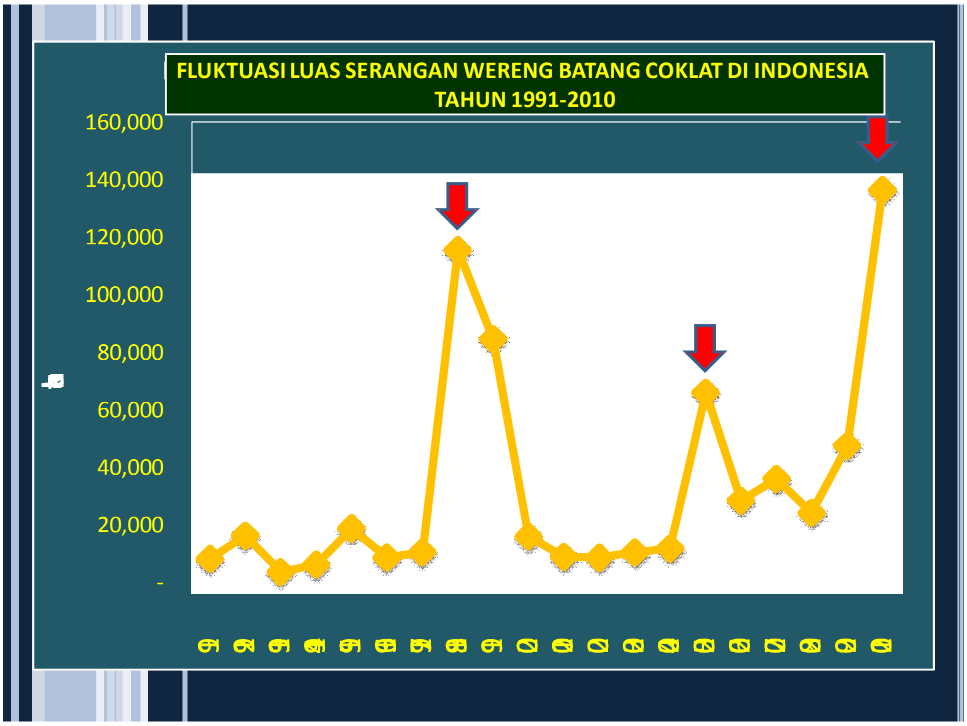
Interpretations

The climate phenomena of La Niňa in late 2008 and early 2009 followed by El Niňo in late 2009 and continuous weak to moderate La Niňa from April 2010 into 2012 were producing ‘unusual’ climate conditions which were surprising many parties, in particular those dealing with crop farming. El Niňo and La Niňa occurrences however are common climate phenomena. They can induce unusual consequences for people’s habitual practices in cultivating crops. Similar outbreaks of pests/diseases in the repeated irregular occurrences of El Niňo and La Niňa are examples of phenomena in which climate elements must be considered important factors. They are conducive to the outbreaks of particular pests such as BPH. Nevertheless, various other factors (biophysical, social, economical and even political) resulting from people’s interaction with their immediate environments could intensify or (when handled more appropriately) decrease the degree of pest/disease infestations.

In a national evaluation meeting of the Directorate of Plant Protection, Ministry of Agriculture, in Pontianak on the 9th of October 2011, Mr. Budyanto, the Director General of Plant Protection, stated that the condition of crop production in Indonesia was constrained by two major things: 1) the outbreaks of pests and diseases; and 2) the occurrence of floods and droughts, which both were related to climate.

In showing the graph of the fluctuation of BPH in Indonesia in 1991-2010, Mr. Budyanto argued that the peaks of the two most serious outbreaks were correlated with the occurrence of La Niňa (Budiyanto 2011) (see Graph 1).

The graph shows the peaks of BPH outbreaks in 1998, 2005, and 2010 with its highest score (up to 140,000 ha) in comparison to 120,000 ha in 1998. Is there any similarity of La Niňa in those years?



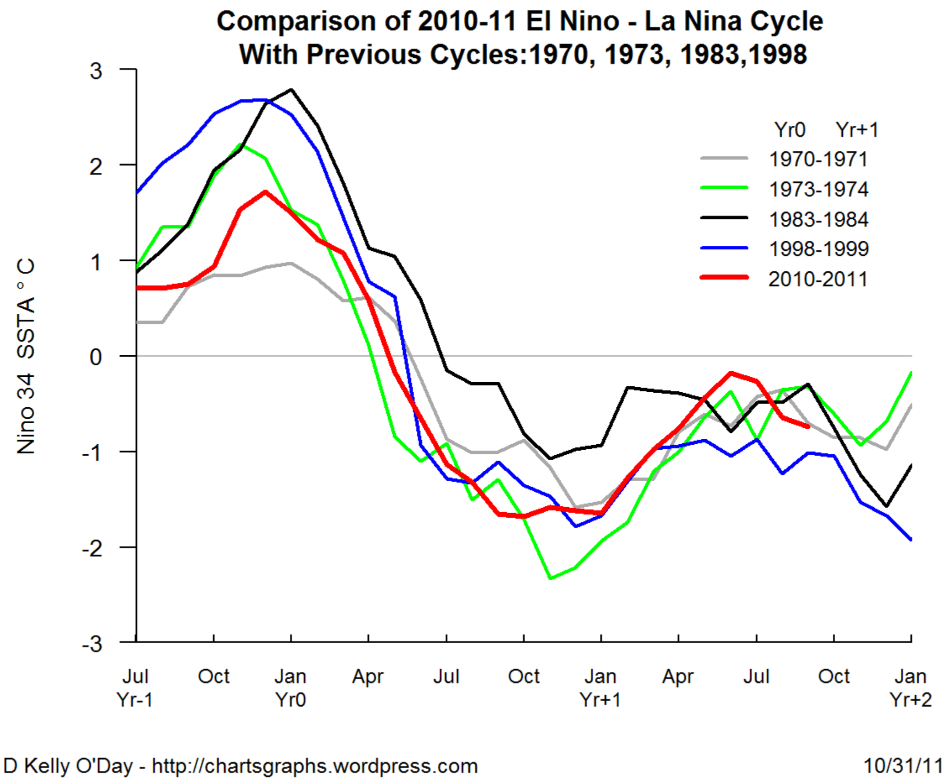
Graph 1. The fluctuation of the size of areas invested by BPH in Indonesia in 1991—2010. Source: E. Budiyanto (2011), Directorate of Plant Protection, the Ministry of Agriculture at a meeting on "Food Crop Protection Policy in 2011" in Pontianak on 9 October 2012.

From the Climate Charts posted by Kelly O'Day on January 25, 2011, the 2010—2011 cycle seems to be following a similar path to four previous cycles shown in the chart (see Graph 2): the 1970—1971; 1973—1974; 1983—1984; and 1998—1999.

The current La Niňa is close to the La Niňa lows in 1998—99 and 1973—74. The year of 1998—99 was mentioned by Budiyanto (2011) as also having witnessed the outbreak of BPH (Graph 1), similar to 2010—2011.

Climate parameters such as temperature, rainfall and relative humidity routinely measured as meteorological data have been used for the analysis of climatic factors influencing the level of occurrence of BPH in rice fields. BPH infests rice plants at the bottom part of the stems.

Thus, the microenvironment under the plants' canopy is significant for the survival of pest population which has a robust growth pattern. Not only the increase of rainfall duration would affect the relative humidity, but also the close distance among rice hills. The humid microclimate is thus a prerequisite for the survival and growth of nymphs of the pest.



Graph 2. Source: (http://chartsgraphs.wordpress.com/2011/01/25/comparison-of-2011-11-el-nino-la-nina-cycle-with-previous-cycles/

Prof. Yunita Winarto posted information that was collected from farmers in central and west Java on the lower occurrence of BPH infestations in SRI rice, with larger distances between plants, in a discussion on BPH outbreaks on the Global Farmer Field School List Server. The microclimate may indeed be involved here. The optimal temperature for the pest to grow was determined around 18—28 °C. Higher temperatures within this range could shorten the life span of the pest, which could further increase the number of generations of BPH to stay alive in one planting season.

However, Stigter argues that other generally applicable conclusions than the above have not so far been obtained. Only statistical relationships between climate and BPH outbreaks are available, whereas the cause and effect connections of these relationships are little known.

The existing literature shows that rainfall, temperature and relative humidity are positively related to BPH outbreaks, where and when they are all high. Win *et al.* concluded recently from their experimentation that BPH population was high under heavy rainfall, high temperature and high humidity. On the contrary, low rainfall and low humidity were, according to them, partially responsible for the decrease of BPH population. Whilst they relate these conditions with different seasons (rainy and dry seasons), our findings reveal that within the continuous rains throughout the 2009/2010 rainy season and the 2010 dry season, up to the first rainy season of 2011 all over Java, there were a great range of BPH outbreaks across diverse regencies, but also in adjacent fields in the same regency.

It has been observed that water availability and water condition in the fields affect the plant performance. High rainfall in irrigated rice fields without a good drainage system due to low elevation, flat topography and other management factors could increase the relative humidity. The continuous rains throughout the year in 2010 also provided dilemmas for farmers, in particular in the dry season planting. Cultivating secondary crops such as maize, tobacco or vegetables would induce risks of harvest failure due to plant damages and water logging under intensive rainfall. Rice farmers, who were used to plant rice throughout the year (up to three times annually: *padi-padi-pantun*) such as in the 'golden triangle' of Klaten-Boyolali-Sukoharjo in Central Java, were happy to continuously plant rice.

Farmers in that region always experience water abundance from various streams, rivers, and irrigation canals in the Bengawan Solo river basin area, supported by Gadjah Mungkur reservoir in Wonogiri (south of Solo). Such low flat areas with abundant water under the heavy continuous rainfall of the La Niňa of 2010/2011 lead to high relative humidity in closely planted rice which is conducive for BPH to become a serious outbreak followed by viruses transmitted by BPH (grassy-stunted and/or ragged stunted viruses, GSRSV).

The condition was different in the areas where farmers have to rely on rainfall as the main water resource in planting rice in a higher elevation and undulating topography. Lack of water in the fields would reduce the relative humidity. In the La Niňa of 2010/2011, farmers in that area could have the benefits of planting rice in the dry season with the certainty to get yields. However, the water condition was more constraining in the third season in comparison to those with abundant water throughout the year. Fallowing the field was the option. Thus, organizing water conditions in the fields (abundant water or lack of it at various growth stages of paddy) could play a significant role in the occurrence or not of high relative humidities, which effect on BPH may be considered as confirmed by the statistical relationship.

Concluding arguments

Climate elements are thus not the sole factors in affecting the microenvironment of rice fields which could induce the outbreaks of a robust growth patterns of a pest like BPH. Water management by farmers and the state is one example of human activities which play a role in increasing or reducing the relative humidity under the condition of water availability in particular places.

As argued by a number of scholars, various other factors originating from farmers' decisions in managing their crops and fields play a significant role as well (also see our mid-term report 2011). Those factors are, among others:

1) the susceptibility of rice varieties planted continuously along with the co-evolutionary process of BPH;

2) the release of hybrid varieties which are not resistant to certain pests/diseases;

3) the planting times and cropping patterns which provide feeding habitat for the pest the whole year round;

4) the misuse and overuse of fertilizers and insecticides. Excessive use of urea as nitrogenous fertilizer and insecticides can lead to outbreaks by increasing the fecundity of the BPH, and by reducing populations of natural enemies. Differential mortality of predators and hoppers does, however, not appear to be the primary factor for resurgence.

In summary, the rice ecosystem sustainability is under jeopardy. Its vulnerability is a very crucial factor as the prone habitat for the unchecked growth of BPH.

Examining the origin of the recent outbreaks and the factors conducive to pests' infestation in different places in Java would help us understand better the conditions under which BPH population became extremely high and damaged the rice crops. Since these outbreaks happened 25 years after the 1985-1986 severe infestation, it is interesting to know the similarities and differences between the two BPH resurgences. The same applies to the 1998/1999 observed BPH outbreaks.