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The Gold Standard: A Qualitative Framing Analysis of Newspaper Coverage of Golden Rice in the United States and Philippines

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Abstract

Vitamin A deficiency (VAD) is a major issue in developing countries and affects approximately 250 million children, and blinding 500,000 a year. A proposed intervention to VAD is Golden Rice, a rice that has been genetically modified (GM) to contain beta-carotene, the precursor to Vitamin A. However, Golden Rice is often associated with negatively perceived GM food. Because the media is the most trusted source in providing food-risk related information, a framing analysis of Golden Rice in United States and Philippine newspapers was conducted to determine past and current frames used to describe the rice.

Understanding such frames could help domestic and international extension workers develop effective communication strategies and educational opportunities. In the United States, GM food was typically the main topic, and Golden Rice was used as a supporting argument. Science and humanitarian frames were used to describe the rice in the U.S. articles. Golden Rice was more often the main topic in the Philippine articles, and more frames were identified: human health, science, policy, risk, and conflict. Golden Rice appears to be in the emergence phase of the framing cycle in the U.S. and in the conflict/resolution phase in the Philippines. Extension in the U.S. and the Philippines should provide education toolkits to journalists about Golden Rice and consider providing press releases to shape the frames used by the media.

Extension workers in the Philippines should educate consumers and farmers about the science of Golden Rice to help them create informed opinions toward the product

Keywords

Golden Rice, Genetically Modified Food, Framing, Newspapers, United States, Philippines

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Abstract

Vitamin A deficiency (VAD) is a major issue in developing countries and affects approximately 250 million children, and blinding 500,000 a year. A proposed intervention to VAD is Golden Rice, a rice that has been genetically modified (GM) to contain beta-carotene, the precursor to Vitamin A. However, Golden Rice is often associated with negatively perceived GM food. Because the media is the most trusted source in providing food-risk related information, a framing analysis of Golden Rice in United States and Philippine newspapers was conducted to determine past and current frames used to describe the rice. Understanding such frames could help domestic and international extension workers develop effective communication strategies and educational opportunities. In the United States, GM food was typically the main topic, and Golden Rice was used as a supporting argument. Science and humanitarian frames were used to describe the rice in the U.S. articles. Golden Rice was more often the main topic in the Philippine articles, and more frames were identified: human health, science, policy, risk, and conflict. Golden Rice appears to be in the emergence phase of the framing cycle in the U.S. and in the conflict/resolution phase in the Philippines. Extension in the U.S. and the Philippines should provide education toolkits to journalists about Golden Rice and consider providing press releases to shape the frames used by the media. Extension workers in the Philippines should educate consumers and farmers about the science of Golden Rice to help them create informed opinions toward the product.

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Introduction

Vitamin A deficiency (VAD) is the number one cause of preventable blindness of children in the world (World Health Organization [WHO], 2014). VAD has been shown to significantly increase children's risk of disease and even death (WHO, 2014). The WHO (2014) estimates 250 million children are already vitamin A deficient and up to 500,000 of those children will be blind in the next year. While VAD is present in more than half of the countries in the world, the majority of inflicted children reside in Africa and East-Asia, particularly in low-income homes (WHO, 2014). Families living in developing countries are at the greatest risk for nutrient deficiencies due to their diets consisting mainly of starchy products containing no micronutrients (International Rice Research Institute [IRRI], n.d.).

A number of interventions have been introduced in recent years to combat the problem of VAD, such as breast feeding young children, Vitamin A supplementation, food fortification, and dietary diversification through home gardens (WHO, 2014). Even with these different approaches, VAD remains prevalent (IRRI, n.d.). Hard to reach target populations can be missed, and some VAD intervention programs can cost up to two million dollars for countries the size of Nepal (U.S. Agency for International Development, 2004). An alternative solution to VAD is genetically modified (GM) rice commonly called *Golden Rice* (IRRI, n.d.)

The crop was developed in 1999 (IRRI, n.d.) and was genetically modified to carry the pre-cursor to vitamin A, beta-carotene (Ye et al., 2000). One cup of Golden Rice could supply 50% of the recommended daily allowance of Vitamin A for an adult (Tang, Qin, Dolnikowski, Russell, & Grusak, 2009). Because rice is widely consumed and produced, this innovation has the possibility to impact a

large number of people, including those who live in more remote areas, or those who could not afford additional sources of Vitamin A (IRRI, n.d.).

Not everyone views Golden Rice in a positive way. Typically speaking, consumers are skeptical of GM food (Fernandez-Cornejo & Caswell, 2006; Mahgoub, 2016). Consumers associate a high level of risks with GM food, including human health issues, environmental impacts, and loss of agricultural productivity (Napier, Tucker, Henry, & Whaley, 2006). Greenpeace, the largest independent environmental agent in the world, has taken a stand against Golden Rice (Greenpeace, 2014). The organization has said "'Golden' Rice is environmentally irresponsible, poses risks to human health, and could compromise food, nutrition, and financial security" (Greenpeace, 2014, para. 1). However, a recent meta-analysis concluded that GM food pose little to no risk to consumers (National Academy of Sciences, 2016). Opponents to Golden Rice also claim that the product is not intended to help the poor, but rather promote the image of agricultural biotechnology and GM food (Charles, 2013).

VAD is a major problem in the Philippines (Dawe, Robertson, & Unnevehr, 2002), yet most of the farmers there have very little knowledge about Golden Rice (Chong, 2003). This is likely because the debate of its use remains in more urban or elite settings rather than rural areas (Chong, 2003). Also, because opinion leaders typically have greater access to media outlets than others in the community (Rogers, 1995), it is likely that the farmers have not been widely exposed to reports on Golden Rice. The information that Filipino farmers have collected about Golden Rice has been from who they consider to be credible sources, typically from personal connections at the Philippine Rice Research

Institute (Philrice) and other farmers (Chong, 2003).

Extension in the United States (U.S.) and abroad have the potential to educate both the public and farmers alike on the use of Golden Rice. Extension has to work closely with media outlets to promote their projects (Vinyard, Akers, Oskam, Doerfert, & Davis, 2008). Successful extension programs require communication with the public that will facilitate awareness and increase interest (Chappell, 1994). In the U.S., extension agents prefer to use word of mouth through their clientele to spread information (Telg, Irani, Hurst, & Kistler, 2007). However, the agents have utilized press releases to communicate to the general public about their programs. Vinyard et al. (2008) recommended that extension and commodity organizations provide media with pre-written press releases to promote their projects. Additionally, the researchers suggested providing educational tools to reporters to help them understand the more scientific content they would be reporting on. Similarly, Benedict et al. (1995) recommended that extension workers send content related material, like food safety information, to reporters because they are not trained in that area.

The review of literature related to extension yields limited results in regard to treating the media as a stakeholder. Yet, the media are the most trusted source in providing food-risk related information to consumers (Frewer, Howard, Hedderley, & Shepherd, 1996). Unfortunately, the media can also serve to stigmatize the potential risks of food technology (Mahgoub, 2016; McCluskey, Swinnen, & Vandermoortele, 2015) because news sources typically cover the moral and ethical dilemmas surrounding food products rather than the science (Meyers & Abrams, 2010). The media's negative coverage of topics like GM food has been linked to negative perceptions of

the food by the public (Marques, Critchley, & Walshe, 2014; Vilella-Villa & Costa-Font, 2008). Because Golden Rice is still in developing stages, extension workers, in the U.S. and abroad, have the opportunity to focus the communication and education on the science of the product. However, the media's lack of attention to food science (Meyers & Abrams, 2010) combined with the opinion of Greenpeace (Greenpeace, 2014) could shut down the research before the rice can be commercialized. Negative coverage could increase risk perceptions, which are known to decrease acceptance of a new technology by the public (Slovic, 1987). Therefore, understanding how Golden Rice has been framed in the Philippines is vital because the country is largely impacted by VAD. Framing of Golden Rice in the U.S. is also important to explore because media coverage can shape decision makers' and the public's opinion. The purpose of this research was to explore how the media has framed Golden Rice in the Philippines and the U.S.

Theoretical Foundation

Framing theory guided this study. Journalists use frames to filter large amounts of information, determine what is important, and effectively communicate information to the public (Gitlin, 1980). Frames are closely related to agenda setting, a phenomenon that occurs when the media places more emphasis on certain issues that can drive public opinion (McCombs & Shaw, 1972). The primary purpose of message frames is to show specific information, ideas, or images when *applicable* to an issue, in contrast to agenda setting, which simply make issues *accessible* to the public (Nelson, Clawson, & Oxley, 1997; Price & Tewsbury, 1997). Agenda setting is used by stakeholders to gain both public and policy maker support for their positions (Miller & Riechert, 2001). Stakeholders are defined as

groups or people who “stand to win or lose as a result of a policy decision” (Lyons, Scheb, & Richardson, 1995, p. 497). These groups are able to influence public opinion by manipulating the frames in which they present information (Miller & Riechert, 2001). For example, when supporting a certain issue, stakeholders will purposefully exclude contradictory viewpoints or facts (Miller & Riechert, 2001). This process becomes obvious when stakeholders begin to compete for support (Miller & Riechert, 2001).

Miller and Riechert (2001) identified a framing cycle influenced by the persuasion efforts of stakeholders in agenda setting. The first stage of the cycle is the emergence phase, where journalists simply report news once an issue has become relevant to the public (Miller & Riechert, 2001). Once the issue is in the public agenda, stakeholders begin to compete with one another by using different frames in the conflict/definition phase (Miller & Riechert, 2001). These frames will drive a certain position, and the continuing conflict between stakeholder groups will create the attention necessary to attract audiences and continue the media’s coverage on the issue (Miller & Riechert, 2001). Eventually, one of the stakeholder’s frames will connect more strongly with the public’s values, and the issue will have reached the resonance stage (Miller & Riechert, 2001). As the stakeholders realize the public views a certain frame more positively, they will continue to emphasize that frame, thus overshadowing the opposition’s message (Miller & Riechert, 2001). The resolution phase is reached once one frame dominates the argument and decision makers conform public policy to align with that frame (Miller & Riechert, 2001). Even though the debate appears over, the opposition can always bring new information to light, break the equilibrium,

and the cycle will begin again (Miller & Riechert, 2001).

A number of studies using framing have been conducted in the agricultural industry (Goodwin & Shoulders, 2013; Marks, Kalaitzandonakes, Wilkins, & Zakharova, 2007; Mula, 2007). Research by Goodwin and Shoulders (2013) used framing theory to describe how cultured meat was portrayed by newspapers in the U.S. and the European Union (EU). The researchers concluded frames highlighting current problems within the livestock industry would create stronger personal relevance with the public because they had already been exposed to that frame. The study also concluded that most of the sources used for cultured meat stories were proponents or academics, but few were members of the industry (Goodwin & Shoulders, 2013). Additionally, because the technology was so new, Goodwin and Shoulders (2013) estimated that the story was still in its emergence phase of the framing cycle, likely to continue with momentum into the conflict stage.

Hoban (1995) states that the mass media are selective with their coverage of agricultural biotechnology and typically focus on the danger rather than the safety. Marks, Kalaitzandonakes, Allison, and Zakharova (2002, 2003) looked at media coverage of GM plants in the U.S. and the United Kingdom. The majority of the stories focused on the environmental risks of GM plants over their benefits. A framing study by Marks, Kalaitzandonakes, Wilkins, and Zakharova (2007) compared medical and agricultural biotechnology frames in the U.S. and in London. The study found the frames in both countries became more negative toward agricultural biotechnology over time in correlation with a decrease in public opinion. Additionally, stories about medical biotechnology typically presented more positive frames compared to stories

about agricultural biotechnology (Marks et al., 2007). An overall conclusion from this study was that understanding news' frames would provide insight into how public opinion can be influenced by media coverage (Marks et al., 2007). Krause, Meyers, Irlbeck, and Chambers (2015) conducted a content analysis (similar to framing analysis) of YouTube videos supporting and opposing the labeling of GM food in California. The proposed labeling bill did not pass, and the majority of videos opposing the bill used scientists and sources. Krause et al. (2015) concluded that the video viewers likely viewed the scientists as credible and were influenced by the statements.

Mula (2007) conducted a framing analysis of Golden Rice in Filipino newspapers from 2000-2004 and found limited coverage of the topic, concluding the rice had not yet gained the media's attention. Newspapers that had covered Golden Rice in the Philippines used frames like health, regulation, and environment when discussing the rice (Mula, 2007). Understanding how Golden Rice has been framed in the past can give researchers an idea about how the product is currently framed by the media. Assessing both past and present frames will enable extension workers, in the U.S. and abroad, to develop effective frames to promote the use of Golden Rice.

Purpose

The purpose of this research was to gain a better understanding of the frames used to describe Golden Rice in the U.S. and the Philippines. The findings will help extension agents to develop a position on the issue and create future communication about Golden Rice. The following research questions guided the study:

- 1) How have print media framed the issue of Golden Rice in the U.S. and in the Philippines?
- 2) What sources have been used by print media to discuss Golden Rice in the U.S. and the Philippines?

Methods

A qualitative framing analysis was conducted to examine media coverage of Golden Rice in the U.S. and the Philippines. Qualitative research can be used to study controversial subjects or experiences to gain greater understanding of how meaning can be translated to an individual (Denzin & Lincoln, 2000). This type of research does not rely on counting or statistics but rather attempts to grasp a deeper understanding of the relationship between documents of study and conceptual issues (Altheide, 1996). Findings from framing analyses are "limited to the framework of categories and the definitions used in analysis" (Wimmer & Dominick, 2006, p. 154). Limited media coverage and messages relevant to the research can also be a limitation to this type of research (Wimmer & Dominick, 2006). Topics which have received limited coverage by the media will need to have a larger body of media content analyzed for researchers to have a sufficient amount of messages for analysis (Wimmer & Dominick, 2006). Newspapers were chosen for analysis in this study because they are considered the most relied upon media source (Rosenstiel, Mitchell, Purcell, & Raine, 2011). Studies have also found that newspapers were effective in promoting knowledge gain to rural populations (Prathap & Ponnusamy, 2006). Newspapers circulating in the Philippines were analyzed in addition to U.S.' papers.

An online database, Lexis-Nexis Academic, was used to compile the sample of articles for this study. Newspapers were selected that were published between 1999 (when Golden Rice was first developed;

IRRI, n.d.) to the time the research was conducted in 2014. Additionally, the search “Golden Rice” was used in all fields. There were 1185 matches in total, 218 articles were from the U.S., and 133 were from the Philippines. National and local papers were selected for the sample due to the limited coverage of Golden Rice in the U.S. Letters to the editor, book reviews, and press releases from organizations were excluded from analysis because they would not reflect framing of Golden Rice as portrayed by the media. Additionally, articles containing less than 200 words, duplicates, and irrelevant articles were eliminated (Goodwin & Shoulders, 2013). After narrowing the population from 351 articles, there were a total of 77 ($N = 77$) articles; 43 from the U.S. and 34 from the Philippines. Due to the small population ($N = 77$), a census of all articles found in the U.S. and Philippines was analyzed (Wimmer & Dominick, 2006). However, there is no way of confirming this was actually all of the newspaper articles published at this time. Each newspaper article was assigned a unique identification number for the coding process.

Creswell (2007) suggests that qualitative researchers assess the validity of a study with at least two different strategies. This study used peer debriefing and identification of researcher bias to address validity and reliability prior to data collection and analysis. A peer debriefer reviewed all methodology and interpretation of frames made by the primary investigator to help identify bias or discrepancies (Creswell, 2007). Training of the primary coder was conducted with the help of a peer debriefer to clarify definitions, revise category boundaries, and edit the coding sheets until the researcher was comfortable and consistent with the materials and procedures (Wimmer & Dominick, 2006). The primary coder and peer debriefer would read the same article and assign frames to

words and phrases until they were in agreement with the frame definitions. Approximately 10% ($n = 8$) of the articles were used for coder training to ensure the validity of the coding instrument (Wimmer & Dominick, 2006). Identification of researcher bias allows readers to better understand how the researchers may have interpreted the results (Cresswell, 2007). The primary investigator in this study was a graduate student with a background in plant genetics and agricultural communications. The peer debriefer was a graduate student as well and had experience in agricultural communications.

A code sheet and guide were developed by the researcher and reviewed by a panel of experts prior to data collection. The code sheet included newspaper name, newspaper location, publication date, number of words, newspaper section, headline, and type of article (editorial, feature, or news). Main and secondary topics were recorded along with frames used for Golden Rice, and sources used to describe the crop. Emergent coding was used to “establish categories after a preliminary examination of the data” (Wimmer & Dominick, 2006, p. 159).

Results

Research Question 1

Golden Rice was rarely covered as the main or even secondary topic in the U.S. articles. The majority of the time, the rice was used as a supporting statement for the use of GM food in general. After initial analysis, 21 frames were identified in U.S. newspapers to describe Golden Rice. Frames were condensed if they were similar and eliminated if not prevalent across the majority of the newspapers. Only two frames were identified as being emergent in the U.S.: humanitarian and science.

Humanitarian frames were identified when words or phrases indicated that Golden Rice was developed for the well being of people around the world. An article in *Providence Journal* demonstrated the frame when describing, “Genetic modification promises even greater benefits to humanity... Making [Golden Rice] available to developing countries would save thousands of lives, and it would be more cost effective than providing vitamin supplements or fortifying food.” Many of the articles discussed the impact golden rice could have on people’s lives. A *Contra Costa Times* article stated, “The Rockefeller foundation reports that golden rice is preventing thousands of cases of childhood blindness and reducing the amount of anemia suffered by more than 2 billion women in rice dependent countries.” Similarly, an article in the *St Paul Pioneer Press* said, “ ‘Golden Rice’, as the stuff is called, probably won’t make a splash here in the U.S., but in the Third World, it will be a godsend.” A number of newspapers even used the word humanitarian when describing Golden Rice. “The industry hopes that crops like golden rice will be more acceptable to the public, particularly if they serve humanitarian purposes,” read a quote from an article in *The New York Times*.

Science frames were defined as phrases used to describe the process of developing or utilizing Golden Rice to produce Vitamin A. *Contra Costa Times* in California released an article which stated, “This genetically altered rice was modified to contain beta-carotene (which readily converts to Vitamin A) and new genes to overcome iron deficiency.” A *USA Today* article used the frame as well describing Golden Rice as “a gene taken from daffodils to produce vitamin A.” *The New York Times* similarly described Golden Rice in an article as containing “bacterial and daffodil genes that allow it to make a nutrient that the body

converts to vitamin A.” The science frame was often used in the initial introduction of the rice.

Contrary to findings in the U.S., the Philippines reported on Golden Rice as the main or secondary topic in the majority of their newspapers. There were originally 24 frames identified in the Filipino newspapers. After consolidation and elimination for lack of prevalence, there were five emergent frames: human health, policy, risk, science, and conflict.

Human health frames were identified when health was discussed in relation to VAD and Golden Rice. The *Manila Times* released an article that stated, “If [Golden Rice] proves suitable, researchers said it would help prevent Vitamin A deficiency, which affects four out of 10 Filipino children six months to five years old.” Many of the newspapers discussed human health in a way to demonstrate that Golden Rice was not necessary in the Philippines. An article from the *Philippines Daily Inquirer* reported “the number of children suffering from Vitamin A deficiency has declined from 38% in 1998 to only 15.2% in 2008.” A *Business World* article provided a quote saying, “ ‘A daily diet of green and yellow vegetables and fruits, including kamote (sweet potato), is enough to ensure that our bodies get enough Vitamin A.’ ”

The newspapers in the Philippines often discussed the policies and regulations concerning the development and commercialization of golden rice, which led to the *policy frame*. *Business World* stated, “The World’s leading biotech crop advocate has predicted boldly that the GM beta carotene-fortified Golden Rice will secure approval for commercialization in the Philippines in the next two years.” Policy frames were also used to illustrate the need for stricter regulations for GM food when talking about Golden Rice. An article in the *Philippines Daily Inquirer* reported, “[An

NGO officer] said the [Philippines] should adopt a national policy to prevent the spread of GM organisms.”

Risk frames were defined as phrases and words used to describe the risk or threat Golden Rice could pose to the environment, humans, and the agricultural industry. This frame was the most used in Filipino newspapers. Many of the articles used the word “risk” when describing Golden Rice, such as “[Golden Rice] pose serious risks to humans,” and “[Golden Rice] not only put the rice- eating Filipinos at risk but would mean the death sentence for ...local rice farmers” as stated in articles from *Business Mirror*. Similarly, a *Philippines Daily Inquirer* article reported that “Farmers and environmental groups on Tuesday vowed to do everything they could to stop the release of GM ‘Golden Rice’ in farms and markets owing to its purported health and environmental risks.” *Business World* added, “Organic food advocates in Mindanao earlier urged the Department of Agriculture to stop the production of GM ‘Golden Rice’ for fear that it will contaminate organic rice.”

Phrases describing the scientific process involved in the development or utilization of golden rice were defined as *scientific frames*. Many articles went into detail describing how Golden Rice would be used as a Vitamin A source. A *Business Mirror* article reported, “developed by the Department of Agriculture, golden rice is an ordinary rice variety, GM to contain beta-carotene from naturally occurring bacteria in the soil... the human body processes the needed vitamin A, flushing harmlessly the excess beta-carotene.” Other articles went into detail describing the scientific advancements in the rice. “There has been significant improvement [in beta-carotene content]. Now we have 15%-25% micrograms of beta-carotene per gram from

less than 10% before...” stated an article in *Business World*.

Conflict frames were defined as words or phrases used to describe the physical actions taken by opponents to Golden Rice. This frame became prominent after activists destroyed a Golden Rice test field in 2013. An article in *Philippines Daily Inquirer* used the frame to describe the incident by saying, “A top member of the [IRRI] expressed his disappointment over the data they had lost after a group of anti-[GM food] activists stormed and uprooted crops from a field testing site of Golden Rice...” A *Business Mirror* article reported the story using a conflict frame as well, but focused on the farmers’ point of view, “In a news conference, [NGO] said the uprooting of Golden Rice plants [in research fields] is but a signal that ‘farmers are frustrated and annoyed with the lies and deception of GM [food]’”.

Research Question 2

Twelve of the 43 articles in the U.S. used sources in their writing. Few of the sources were used to describe Golden Rice, and the majority of sources were used to reference GM food. Mostly industry and university sources were used in the U.S.’ newspapers. A number of the sources had investment in GM food in general or specifically in Golden Rice. These sources included large agricultural biotechnology companies, IRRI, and even the developer of Golden Rice, Ingo Potrykus. A spokesperson for a large agricultural biotechnology company was cited in an article from *The New York Times* explaining, “‘Respected institutions [are] saying biotechnology has legitimate benefits that can and need to be applied to subsistence crops.’”

Even though a large portion of the sources had a vested interest in GM food, quite a few sources also came from

university professors specializing in botany or genetics from all over the country. The university sources provided more of the science frames and explained the potential use of Golden Rice and GM food. The U.S. primarily used domestic sources and did not provide quotes from institutions, farmers, or consumers in countries affected by VAD or where Golden Rice could be commercialized.

The Filipino newspapers used sources in the majority of its articles. Sources used were typically from one of two stakeholder groups: non-government organizations (NGOs) who were against the production of GM food or the Philippine Rice Research Institute (Philrice). The NGO sources typically focused on the risks and conflicts associated with Golden Rice. An article in *Business World* quoted an NGO director as warning that there would be a “significant risk of the Golden Rice GM gene contaminating the native organic rice once it is commercialized.”

Philrice was often used to describe the potential positive impacts that Golden Rice could have in the Philippines along with the safety of the products. “[Golden Rice] has met international food-safety standards and is as safe as and as nutritious as the food derived from conventional rice,” was a quote provided in a *Business Mirror* article from Philrice. In addition to the previously mentioned groups, the U.S. Department of Agriculture and the Food and Drug Administration were also used in a couple newspaper articles. Farmers and consumers directly affected by VAD were absent from the newspapers and were not used as a source

Discussion

The purpose of this study was to determine the types of frames and sources used to communicate about Golden Rice in the U.S. and the Philippines. By

understanding how the media has framed Golden Rice, extension workers can better understand consumer opinions toward the product and develop future informational and education materials about Golden Rice.

In the U.S., the humanitarian and science frames described what Golden Rice was and why it was developed. The media rarely covered the product as a main topic and often mentioned it as a secondary topic for how GM food could be beneficial for consumption. These findings indicated Golden Rice is likely in the emergence phase of the framing cycle in the U.S. (Miller & Reichert, 2001). As Golden Rice gains more attention from the media in the U.S., differing stakeholder groups will likely begin to present their own frames, attempting to gain control of the message and the public’s opinion toward Golden Rice.

While Golden Rice is in the emergence phase of the framing cycle in the U.S., GM food has been dominating the conversation. In the majority of the articles in the U.S., Golden Rice was talked about as a counter point to the negative accusations made toward GM food. Research has determined that frames toward agricultural biotechnology, like GM food, have become increasingly negative in recent years (Marks et al., 2007). The adoption of Golden Rice may be hindered by negative associations with GM food presented by the media.

A limited variety of sources were used in the U.S. to report on Golden Rice. Even though the industry sources framed Golden Rice positively, readers may be skeptical of the information due to sources’ vested interest in the product (Druckman, 2001). However, university professors and scientists were also quoted, which was consistent with previous research (Goodwin & Shoulders, 2013; Krause et al., 2015) and may help the reader feel more trust toward the information being presented. No one

directly affected by VAD was quoted in any of the articles analyzed in the U.S. Readers may not fully understand the purpose of Golden Rice in developing nations due to a lack of sources describing the science and intent of the product. Additionally, the humanitarian frame placed Golden Rice far away from the U.S. geographically, and readers may not find the product personally relevant. There were also no quotes in the newspapers from extension. This absence of information could mean that either extension has not been communicating with the media about GM food or that the media has been choosing to not release information from this particular source.

The majority of the articles from Filipino newspapers focused on Golden Rice as the main or secondary topic, which contradicted previous research (Mula, 2007), and indicated the issue had moved into the media's agenda. Similar frames to those identified by Mula (2007) were defined during analysis. The Filipino newspapers used science frames, parallel to the U.S., when initially discussing Golden Rice as well as human health frames. Unlike the U.S. though, the Philippine newspapers used the human health frame to both show the need for Golden Rice and as a way to demonstrate the product was unnecessary. Additional frames of conflict, risk, and policy were defined. Risk and policy frames had previously been identified in a number of other studies about GM food (Marks et al., 2002, 2003; Marks et al., 2007). The conflict and risk frames became dominant in the more recently published articles, which indicated these frames may have been resonating more strongly with the public than other frames (Miller & Reichert, 2001).

Conflict and risk frames focused on the negative attributes of Golden Rice, which was consistent with previous research that concluded agricultural biotechnology frames became more negative over time

(Marks et al., 2007). The conflict, risk, and policy frames reflect research in agriculture that indicated media focuses on the danger rather than safety of biotechnology (Hoban, 1995).

Sources used in the Philippine newspapers were either pro or anti- Golden Rice. The stakeholders were quoted in the majority of the articles, which contrasts with findings from the U.S., where only a handful of articles provided quotes. The majority of sources used in the Philippines were organizations who opposed Golden Rice. Farmers and citizens impacted by VAD were never quoted. Filipino consumers may find it difficult to understand what information to trust when the sources used have a vested interest in the commercialization of the product. Similar to the U.S., international extension was not used as a source. Additionally, the lack of quotes from farmers and citizens may not make the information relevant to citizens who have not been affected by VAD.

The polarized sources of research organizations and NGOs, along with the numerous frames, indicated that the issue of Golden Rice had reached the conflict/definition phase of the framing cycle, in the Philippines (Miller & Reichert, 2001). Stakeholders were utilizing frames to compete for public support (Miller & Reichert, 2001). For example, the duality of the human health frame could indicate that multiple stakeholder groups have been using the frames as a way gain support since they know consumers are already familiar with it (Miller & Reichert, 2001). Similarly, conflict frames were used to place blame on either the activists or the researchers for the vandalism of the research fields in the Philippines.

Recommendations

This research found that media coverage of Golden Rice differed between

the U.S. and the Philippines. However, there are recommendations for extension that could apply to both U.S. and Filipino workers. Because extension was not used as a media source in either country, extension workers need to reach out to the media to increase knowledge concerning different agricultural programs. Providing educational toolkits can help encourage reporters to deliver informed, accurate information to the public (Vinyard et al., 2008). Additionally, extension should consider writing press releases to frame the messages about Golden Rice themselves (Vineyard et al., 2008). Press releases will be important to use in areas where Golden Rice is still in the emergence phase of the framing cycle, like in the U.S. Extension should be proactive in communications about Golden Rice so consumers are presented with science-based information and can make informed decisions about the product. Because the humanitarian frame is already used in newspapers, it would be beneficial to frame the science-based information from a humanitarian perspective. Additionally, developing frames to make Golden Rice more personally relevant would likely help to develop positive consumer perceptions. One example of a personal frame could be a story about a child who is suffering from VAD and explaining how the science behind Golden Rice could alleviate issues with the deficiency. The use of sources like university professors will also help to increase the credibility of the information presented so consumers' can trust the communication of the science.

Extension workers in the Philippines will have to utilize slightly different tactics to influence media coverage of Golden Rice because it has already reached the conflict/definition phase of the framing cycle (Miller & Reichert, 2001). Extension should still communicate to the media and consider creating press releases, but they

will have to utilize frames that resonate with their stakeholders. Frames should focus on how the science of Golden Rice can impact human health and address Filipino's concerns of risks related to the product. This would expose Filipinos to both opponents' and supporters' thoughts toward Golden Rice, thus providing them with the opportunity to make an educated decision. Opinion leaders in more urban areas of the Philippines should be identified in order to influence media coverage of Golden Rice as well (Rogers, 1995). Because VAD directly affects so many Filipino's, extension workers in the area need to prioritize their communication with the media to reduce sensationalized coverage of Golden Rice. Negative coverage of the rice in this area could lead to a halt in research.

Because Filipino farmers have little knowledge of Golden Rice (Chong, 2003), they may read the papers and believe the risk and conflict frames being presented by newspapers. Extension workers in the Philippines should attempt to increase farmers' knowledge of Golden Rice by providing accurate information about the product. Additionally, because the Philippine Rice Research Institute was identified as a trusted source in the region (Chong, 2003), personal connections at the institute should be identified to facilitate learning. By lowering the farmers' perception of risk through transparent and trusted communication, the likelihood of the technology being adopted in the area would increase (Slovic, 1987).

Extension workers should consider these recommendations regardless of their location or specialization. The media have a strong influence on the public and decision makers' opinions. Extension should consider developing strong media relations to best communicate about science with the public. If extension can help to educate journalists about their field and consider writing press

releases to control the frames used, different extension projects can be moved into the public's agenda (Miller & Reichert, 2001). If extension does not work with the media, other voices, possibly not backed by science, will frame the issues instead.

This study is not without its limitations. The first is that only the message frames could be observed, and consumers' reactions to the frames were not explored. Future studies could investigate how different message frames influence consumers' opinions toward Golden Rice. The frames discussed in this paper should be researched to determine which ones resonate the strongest with consumers. Investigating the frames presented by other media outlets, like television and blogs, would strengthen this study as well. Researchers should also identify frames used by media in other countries afflicted with VAD. Understanding how different countries present information on Golden Rice will allow extension to have a holistic understanding of the global perceptions of the product.

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