

Cashew production benefits and opportunities in Ethiopia: A Review

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Abstract. Cashew (*Anacardium occidentale* L.) is among the major edible nuts with increasing demand in the global market. The tree is native to Brazil and first introduced to India and Africa in the 16th century by Portuguese traders with the intention of afforestation and soil conservation, and gradually expanded throughout the world. Today, it has been widely grown mainly for its nuts to be used as food, medicine, and source of income in most tropical regions with the largest coverage found in Brazil, India, Vietnam, Indonesia, and several countries in West and East Africa. The increasing demand for raw cashew nut from processors has made the crop to be the major source of foreign exchange in most developing countries. However, despite the huge potential to produce Cashew in Ethiopia, only little is known about its current production, potential benefits, and opportunities in Ethiopia, mainly due to lack of knowledge and awareness. Hence, this paper provides an overview of cashew uses, available opportunities for its production in Ethiopia and the way forward.

Keywords: Cashew, non-growing areas, cashew production benefits.

INTRODUCTION

Cashew (*Anacardium occidentale* L), a multipurpose crop, is native to Brazil and has been spread to other parts of tropical South and Central America, Asia and Africa (INC, 2015). The cashew tree was first introduced to India and Africa by Portuguese traders in the 16th century to prevent soil erosion (Jaeger, 1999). Despite its first purpose of introduction, it is now widely cultivated mainly for its nuts to be used as food, medicine, and source of income in many countries of the world mainly in Asia, Africa and South America (ACA, 2010; Judge and Azam-Ali, 2001). The crop is adaptable to a wide range of ecological differences – it grows in warm regions with an annual rainfall ranging from 1000 to 3000 mm, well adapted to seasonally wet and dry tropical climates, and it gives reasonably good yield on well-drained, light textured soils with minimum inputs. Specifically, with only little care, it can produce an annual average of 50 to 75 kg of apples and nuts per tree, yielding up to 4 kg of

cashew kernels (Ona *et al.*, 2017). Cashew trees are estimated to live 50 to 60 years and start bearing fruit in their third to fifth year.

World production of raw cashew nut (RCN) has grown from 0.29 million tons in 1961 to 4.9 million tons in 2016 with the shifting production capacity in different countries. In Africa, during the same period, production of cashew has grown more than fourfold – that is, from 400000 MT to an estimated 1,800,000 MT (ACA, 2016). Until the 1980s, the trend of RCN production showed slow and steady growth with India being the major cashew producer. India, Mozambique, Tanzania, Brazil, and Cote d'Ivoire were the only producers of RCN up to mid of the 1970s of which African countries, particularly, Mozambique and Tanzania shared the majority (68 percent) of global cashew production. Then after, over the following thirty years, Asian countries took the lead as the world major cashew producers (Figure 2). From the



Figure 1. A) Performance of the two mother cashew trees first grown at PARC [19 February 2015], B) One of the 84 cashew trees grown from the two mother cashew trees as a maintenance – flowering stage [10 December 2015]. C) Cashew apple and nuts harvested from the parent trees [16 March 2013]. Photo by Jemal Tola.

1990s, global RCN production has shown tremendous growth with Vietnam, the newly emerged RCN producer, cashew industry massive growth with respect to domestic cashew nut production and processing (ACA, 2014; Judge and Azam-Ali, 2001).

In the early 2000s, West African cashew production has started remarkably increasing in Nigeria and Cote d'Ivoire (ACA, 2010, 2014). Recent investigations have shown that Cote d'Ivoire overtook the leading position in RCN production from India. Besides, production in other West African countries like Guinea-Bissau, Ghana, Senegal, and Benin are also dramatically increasing merely due to increased area coverage following the huge support from the government and many NGOs (Monteiro *et al.*, 2017). Contrarily, raw cashew nut production in the leading cashew processing countries like India and Vietnam is declining due to labor cost and competition with other crops. This opens huge raw cashew nut market opportunity in other countries. For instance, in East Africa (Tanzania and Mozambique) production has started to recover since the 1990s mainly due to the increasing demand and suitable market of raw cashew nut. Currently, cashew is being produced in 36 countries of the world which are sufficiently warm and humid. Specifically, Vietnam, Nigeria, India, Cote d'Ivoire, Philippines, Tanzania, Mali, Guinea Bissau, Indonesia, Benin, Mozambique, Burkina Faso, Ghana, and Brazil are the main producers (Adeigbe *et al.*, 2015).

The African Cashew Alliance (ACA, 2010) indicated that changing conditions in the industry make African cashew a good investment choice. India and Vietnam currently account for a majority of the world's market for processed cashews, both in terms of processing and exports. Rising labor costs in Vietnam and India, however, is becoming a problem for their cashew sectors.

Hence, to fill the raw material supply gap in their processing industry, they import 90% of the total cashew nut production in Africa. In addition, the rising purchasing power of emerging economies, which traditionally use cashew as an ingredient in many foods, also increases its demand on the international market. Africa's proximity to the U.S.A and Europe, the world's largest markets for cashew products, is another important advantage. Thus, there is an increasing demand for cashew production expansion in Africa from the cashew sector. In recognition to this, recently, there is encouraging progress in Western Africa as it is given due attention by the government and external supporters (ACA, 2016).

However, in many non-cashew growing countries, the emphasis given for the crop production development is insufficient while there is a huge potential. For instance, in Ethiopia, the crop is not yet introduced to farmers and its research (adaptation and maintenance activities) was started recently (2013) only at one of the national research centers – i.e. Pawe Agricultural Research Center (PARC) with limited technical and financial support. PARC is one of the 17 research centers of Ethiopian Institute of Agricultural Research (EIAR) located at 11°19'N and 36°24'E. The crop performance at the center was observed incredible with nut yield performance up to 3.81 kg/tree from five year young cashew tree (PARC, unpublished) (Figure 1). Despite the limited effort to promote the crop in the area, there is high demand from the local farmers (Personal communication with Mr. Andualem Zewudu and Flagote Alemu, Horticulture Research Division of the center). This crop is also hardly known in the other parts of the country. This story is quite similar with the experience of Tanzania, Mozambique, and Kenya though there is a change in recent time. In general, there is a huge gap of understanding about the importance of cashew from both the government and producers side in Africa in general and in Ethiopia in particular. This review was therefore motivated to increase awareness on the benefits of cashew crop and the existing opportunities in the production, marketing and agro-processing of the crop in non-cashew growing developing countries in general and Ethiopia in particular.

CASHEW PRODUCTION BENEFITS

Nutritional Uses

Cashew has two consumable parts – the apple and the kernel. Cashew kernel, which is the main commercial product of the cashew tree is the edible part of the nut, is nutritious, containing fats (46 to 47%, of which 87% are unsaturated fatty acids), protein (18 to 21%) and carbohydrates (29 to 31%) (Brufau *et al.*, 2006). It also has concentrations of phosphorous (593 mg), magnesium (292 mg), and potassium (660 mg), and various vitamins, the main ones being E (0.90 mg) and K

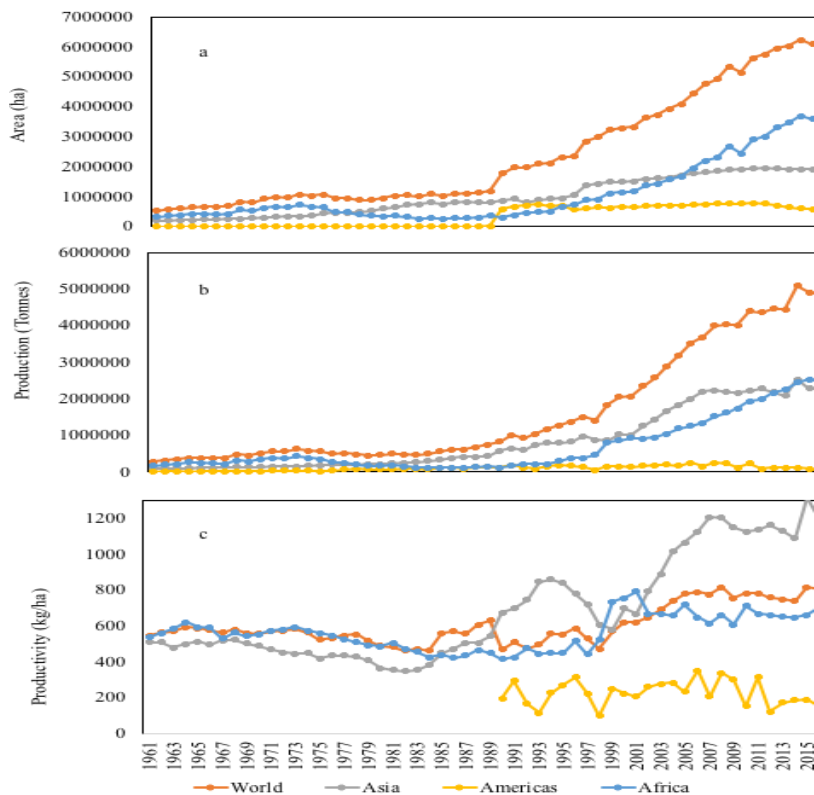


Figure 2. Trends in cashew area coverage, production, and productivity from 1961-2016 in three cashew producing continents i.e., America (south and central), Asia and Africa. a-Trends in cashew area coverage (ha)-, b-Trends in cashew nut, in shell production (Tonnes) and c- Trends in cashew productivity (kg/ha) (FAOSTAT).

(34.1 mcg) (Griffin and Dean, 2017; USDA, 2018).

Cashew can be directly consumed as snacks, roasted and salted nuts alone or in mixture with other nuts or used in recipes, or processed into different products like cashew milk, cashew cheese or cashew butter, which is nutritionally rich compared to soy and dairy milk with low calories (Manzoor *et al.*, 2017).

Health benefits

Cashew and its products are curative to many human health problems and offer a variety of advantages to a human body. In particular, cashew nut helps to lower the cholesterol level in blood, control diabetes and coronary heart disease risk (Desai *et al.*, 2017; Ros, 2010). Cashew nuts are rich in magnesium which is vital for healthy bone development and prevention of high blood pressure (Dendena and Corsi, 2014). Furthermore, the plant creates an antibacterial, vesicant and anthelmintic property. Despite the lower levels of unsaturated fatty acids in the cashews compared to other tree nuts, consumption of cashews could reduce risk of cardiovascular disease (Griffin and Dean, 2017; Van Horn

et al., 2008).

Many scholars reviewed the health benefits of cashew and reported that almost all parts of the plant and their constituent are used as a curative against various human diseases such as a toothache, ringworm, coughs, colds, syphilis, stomach-ache, fever, cholera, kidney troubles, diarrhea, asthma, leprosy, elephantiasis, psoriasis, warts, corns fresh wounds and cuts (Aracelli *et al.*, 2016; Judge and Azam-Ali, 2001; Runjala and Kella, 2017). Anacardic acids supplementation has a potential protective role on oxidative and inflammatory mechanisms in the lungs (Carvalho *et al.*, 2013). Amaral *et al.* (2016) reported that the extracts obtained from the aerial parts of *A. occidentale*, mainly the extract of flowers, are rich in bioactive metabolites that exert a potent antioxidant and antimicrobial effect.

The safety concern of increasing cashew consumption is limited to the infrequent occurrence of nut allergy in children (Ros, 2010). However, homeowners should not attempt shelling and consuming the cashew nut produced by cashew trees grown in the home landscape. The shell contains a reddish-brown, viscous, oily liquid composed of various phenolic lipids. This oil is poisonous and acts as a powerful vesicant, causing extensive blistering of the

skin (McLaughlin *et al.*, 2017).

Industrial uses

Cashew nut shell liquid (CNSL) – containing cardol and anacardic acid has numerous industrial applications such as fungicide, pesticide, insecticide, friction linings, paints, and varnishes, laminating resins, rubber compounding resins, cashew cement, polyurethane based polymers, surfactants, epoxy resins, foundry chemicals and intermediates for chemical industry (INC, 2015; Judge and Azam-Ali, 2001; Taiwo, 2015). The application of CNSL component in bacteriostatic antibiotics is recently gaining attention. Their effect on plant growth, acid activity, wood preservative, and pressure treatment activity are being explored (Taiwo, 2015).

Biological and agricultural uses

Cashew has a superior characteristic to grow well in areas with marginal agro-ecological conditions and dry climates – it is fast-growing, low input and drought-tolerant tree. Furthermore, cashew can be intercropped with other crops like cowpea, groundnuts, horse gram, maize, cassava, yam, and vegetables at establishment phase with high profit when it is intercropped with maize and yam (Lawal and Uwagboe, 2017; Opoku-Ameyaw *et al.*, 2011). Cashew apple extract, cashew nut shell crude extract, and bark gum extract are used as insecticides (Buxton *et al.*, 2017) and antifungal (Kannan *et al.*, 2009).

Economic uses

Cashew is the major export commodity in the main cashew producing and/or processing countries like India, Vietnam, Brazil, and Cote d'Ivoire. Cashew can be traded in two ways: as a raw cashew nut (RCN) or in processed form (mainly cashew kernel). Many scholars reported that cashew kernel is being considered as a high-value agricultural commodity, and interestingly increasing and expanding in international trade (Dendena and Corsi, 2014; Harilal *et al.*, 2006; Judge and Azam-Ali, 2001) because global kernel demand is predicted to increase over the following decade (The World Bank, 2016). India, Vietnam and Cote d'Ivoire are among the leading countries being benefited from cashew products export (ACA, 2014; VINACAS, 2017).

In Ethiopia, export value is deficient and dependent mainly on coffee export. Therefore, introducing and expanding of cashew production is hoped to increase the country's export.

Other uses

Cashew wood is popular for firewood and charcoal. The residue of the shell is often used as fuel in cashew nut

shell liquid extraction plants. Pulp from the wood is used to fabricate corrugated and cardboard boxes. The cake remaining after oil has been extracted from the kernel serves as animal food. Seed coats are used as poultry feed. The ripened cashew apple or its residue could be utilized for the preparation of cattle feed, pig feed and poultry feed (ACA, 2014; Marcel *et al.*, 2011).

OPPORTUNITIES FOR CASHEW PRODUCTION IN ETHIOPIA

The existence of vast land

Ethiopia has abundant fertile agricultural land endowed with water resources (MoARD, 2009). According to Ministry of Agriculture and Rural Development (MoARD, 2009), out of 111.5 million hectares total land area of Ethiopia (45% highland and 55% lowland), 74.3 million hectare is suitable for annual and perennial crop production. However, only 18 million hectares of the arable land was cultivated under rainfed with cereals, pulses, oilseeds, fruits, vegetables, fiber crops, cotton, coffee, tea, spices, and other industrial crops. The ministry estimated 767,300 hectares as investment potential for horticultural crops (that is, fruits and vegetables) in four regions namely SNNP (346,300 ha), Oromia (150,000 ha), Amhara (270,000 ha) and Dire Dawa (1,000 ha) out of nine regions of Ethiopia. However, there are also large and most suitable areas for cashew production in the remaining regions like Benishangul Gumuz, Gambella, Somalia and Afar regions.

Agro-ecological suitability

Cashew requires a warm and humid climate with rainfall between 1000 and 2000 mm having a pronounced dry season and grows from sea level to 1000 m altitudes. It requires hot tropical climate below 1000 m elevations and frost is deleterious for its growth. The distribution of rainfall rather than its quantity is important. Rainfall during flowering and fruiting causes flower abortion due to anthracnose and mildew (DFSC, 2003). The tree can adapt to very dry conditions and can be grown on a variety of soils ranging from sandy to clay (Balogoun *et al.*, 2016; Pareek and Sharma, 2009).

In this regard, Ethiopia has a moderate temperature (average temperature rarely exceeds 20°C (68°F), highly varied altitude ranging from -125 to 4620 m.a.s.l, and annual rainfall ranging from 200 to 2500 mm with average annual rainfall considered to be moderate by global standards (MoARD, 2009). The lowlands typically have sub-tropical and tropical climates. The most dominant soil types are Nitosol, Vertisol, Fluvisol, and Cambisol. Based on climate, soil, and management, Ethiopia is classified into 18 major and 49 sub-AEZs

(Hurni, 1998). The striking differences among regions in altitude, topography, soils, climate and farming system enable the country to produce a variety of field crops, fruits and vegetables and rear different species of livestock (Kassa, 2003). Preliminary observation of cashew performance at PARC confirms that moist kolla (Hurni, 1998) is suitable for cashew production among traditional agroecological zonation of Ethiopia. However, further agroecological suitability study is needed to verify the actually available potential in the country.

Mounting market demand

Today, the world cashew market is considerably increasing along with the increments in cashew production, industry, and consumption worldwide. Vietnam, India and Brazil raw cashew imports are increasing from time to time to supplement their domestic production for processing and then export to USA, Europe and Middle East (RRF, 2012). On the other hand, newly engaged in cashew production, West African countries like Cote d'Ivoire and Nigeria are also joining processed cashew kernel trade putting pressure on raw cashew supply. Hence, raw cashew nut source is getting more attention in the cashew trade.

Cheap and skilled labor

Ethiopia has excess cheap and skilled labor; 1/7 of Chinese and half of Bangladesh (from \$25 to \$200 per labor/month) at manufacturing sectors (EIC, 2016). According to Central Statistics Agency of Ethiopia and International Labor Organization report, the number of children aged 5 to 17 years in Ethiopia is estimated to be 37,332,738 which accounts for 42.6 percent of the national population. Moreover, 80 percent of the total population is fully engaged in agriculture while only seven percent, five percent, and eight percent are engaged in industry, trade and services sectors, respectively (CSA & ILO, 2018).

Availability of supporting institutions

In Ethiopia, major government ministries, agencies, research, and education institutions play an important role in the extension system. All ministries have decentralized coordination up to district level. MoARD has more than 40000 Developmental Agents (DAs) and Farmers Training Center (FTC) at Kebele level (smallest administrative unit in Ethiopia). Ethiopian Agricultural Transformation Agency (ATA) is a strategy and delivery-oriented government agency created to help accelerate the growth and transformation of Ethiopia's agriculture sector. Ethiopian Institute of Agricultural

Research (EIAR) has 17 research centers in various agro-ecological zones of the country and coordinates the decentralized agricultural research activities at federal and regional research centers, and through higher education institutions.

The Ethiopian Investment Commission (EIC) promotes private investment, primarily foreign direct investment. Accordingly, six industrial parks have recently inaugurated for textile and apparel, leather and leather products, pharmaceuticals, agro-processing and others in Hawassa, Adama, Dire Dawa, Kombolcha, Mekelle and Jimma cities (EIC, 2016).

African Cashew Alliance (ACA), Bill and Melinda Gates Foundation, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, TechnoServe – Business Solutions to Poverty, and World Bank are among the major nongovernment organizations actively supporting cashew sector in Africa.

STRATEGIES AND THE WAY FORWARD

Currently, more than 90% of RCN is imported from Africa, in particular, West African countries; Cote d'Ivoire, Nigeria, Ghana, Benin, and Guinea. Even though Africa is the main exporter of cashew it could not satisfy the huge demand for RCN in importing countries since the majority of cashew production in the area is at small scale level. But, literature showed that Africa, especially countries in the tropics have big and yet unutilized potential and cheap labor for cashew production.

Besides, India and Vietnam domestic production are declining due to the decrease in production area as there is competition with other crops. Furthermore, an expensive labor cost in both countries is forcing them to import RCN from East and West Africa. However, due to the shortage and instability of Africa's especially East Africa's cashew supply cashew importing countries like India and Vietnam are changing or complementing their demand with other Southeast Asian countries. For instance, in the early 1980s when East African production reached a low level, India compromised the supply by Vietnamese high RCN supply at the time. Similarly, when Vietnam started processing cashew; the main supply was coming from Africa, but due to a shortage of supply and decreasing domestic production, Vietnam has started promoting cashew production in other Asian countries; Cambodia and Laos (ACA, 2014; INC, 2015). This confirms that Africa is losing a very big market opportunity which can bring remarkable foreign currency.

The other concern is that the majority of African countries often suffer from hydro-metrological disasters like flood and drought (FAO, 2016b). Drought affects the largest portion of the people on the continent, followed by floods and storms. According to OXFAM (2018) report, in the Horn Africa (in which Ethiopia is included) alone, 16 million and 1 million people are affected by drought and

floods, respectively. Impacts of climate change on agricultural systems in Africa are expected to increase in the future unless an appropriate measure is taken (Barros *et al.*, 2014). Consequently, the area is mostly affected by food price volatilities and production variability resulting in increased food insecurity for consumers (FAO, 2016a; Parry *et al.*, 2007; Wubie, 2015). This is due to un-sustainability of vegetation/plants in dry areas which can be successfully recovered by cashew – drought tolerant and low input crop (Dendena and Corsi, 2014; McLaughlin *et al.*, 2017). Cashew is suitable for use in the rehabilitation of degraded lands, afforestation of barren, slash-and-burned farmland and coastal saline sandy lands. The trees are easily cultivated, vigorous and require little care (DFSC, 2003). Though, in fact, cashew production and productivity are improved with sufficient soil moisture (Balogoun *et al.*, 2016; McLaughlin *et al.*, 2017) it can still give yield in such areas. So, cashew production in drought and flood exposed areas is not only important for soil conservation and afforestation but also best to provide additional food option and income source to the producers.

On the other hand, developing countries with huge potential are seldom seen working on cashew production. This could be either due to lack of awareness on the cashew importance and market outlets, lack of funding for research and development, government emphasis or policy related issues. In Nigeria, the increased awareness of the economic benefits of the crop has led to the astronomical increase and renewed interests in the agribusiness of the crop (Hammed *et al.*, 2008). Ghana has boosted the production and processing of cashew nuts for the local market and also as a means of poverty reduction mainly through government-supported investment project in cashew production. Many African cashew producing countries have established cashew focusing organizations to promote.

Starting from the early 1990s different cashew promoting organizations have been established in many African countries and is showing satisfactory progress in cashew production (ACA, 2014). As a result, consecutive increase in RCN production has been recorded in these countries particularly in Cote d'Ivoire and Tanzania. Today, West Africa is the most recent and dynamic in the world, accounting for 45% of the worldwide production of cashew nuts (Monteiro *et al.*, 2017). West African countries like Cote d'Ivoire and Nigeria have started processing and exporting processed cashew nut (Adeigbe *et al.*, 2015). This situation could also open the RCN market opportunity for African countries newly engaging in cashew production.

However, irrespective of the existing huge and untouched production potential, the emphasis given for cashew production in East Africa in general and in Ethiopia, in particular, seems relatively weak as compared to that of Western Africa. It is, therefore, to develop the cashew production sub-sector in Ethiopia; all

stakeholders must devotedly work together and formulate developmental policies for cashew research and development. Research and development play a great role to meet the world market requirement by increasing crop productivity and quality, scaling up and awareness creation on economic potential and benefits of cashew nut production.

To produce cashew in large scale programs high yielding variety with quality products should be used to assure rapid adoption of the crop and sustainable production in non-cashew producing countries. Therefore, increasing the number of crop variety with different purpose by introducing germplasm in non-growing areas will be an immediate necessity and continual activity in the crop production development (Adeigbe *et al.*, 2015). This will be done mainly by agricultural research institutes in collaboration with other organizations. A good example is in the case of Vietnam; many research institutes and agricultural universities in Vietnam are working in collaboration with VINACAS to increase the cashew output in the country (ACA, 2014).

Promoting on radio and television including the print media such as newspaper, leaflets, and others further promote the awareness on the health benefits and market advantages of cashew, thus strengthening the domestic production and economy of the crop.

Availability of sufficient fund is the driving force of any research and development. Therefore, a fund should be ensured both by government and external donors. Now a day, a number of NGOs including the above-stated organizations have been technically and financially supporting cashew sector in Africa. In fact, the initiative should be taken by researchers in developing potential and convincing research projects.

The market is the other pertinent aspect that should be considered for sustainable production of the crop. Improved and reliable marketing channels and fair prices are necessary to sustain farmers' interest in the cashew crop. Even though there is substantial demand in the world market, government focus is demanded to put more effort in searching and selecting a good market for farmers benefit.

CONCLUSIONS

This review addresses that the uses of a cashew tree and its products are vast. The existing supply of both RCN and cashew kernel is insufficient to meet the mounting demand in international trade. On the other hand, the attractive cashew market in different parts of the world is bright for non-growing countries like Ethiopia. Availability of vast land, agroecological suitability, cheap labor, and well-organized agriculture-based institutions in Ethiopia is a great opportunity for the promotion of cashew production. Therefore, a strong collective effort should be made by concerning bodies aiming to sustainably

establish the crop in the country with a broad understanding of its production benefits and magnify the contribution of cashew in reducing food insecurity.

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