Northwest Center for Small Fruits Research

2015 Annual Conference

Welcome to the 22nd annual conference of the Northwest Center for Small Fruits Research in Portland, OR. We hope you will find this year's program interesting and useful.

Rsearch Priorities: During the conference, time is set aside to revisit all research priorities by commodity. Commodity groups will meet separately to review and revise priorities. Please refer to the enclosed schedule for the time and room assignments. Copies of all priorities can be found at the back of this booklet.

Organizational Handbook: The Organizational Handbook has been included in your registration packet. This booklet provides an overview of the NCSFR operations and detailed funding information.

Wine Tasting, Hors d'oeuvres & Poster Session: After the days activities, we will have the opportunity to enjoy sampling a variety of PNW wines during the Poster Session.

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Genetics

Cultivar Development of Edible-Fruited Honeysuckle (Lonicera caerulea L.)

Maxine Thompson, OSU

Conventional plant breeding activities were carried on as in previous years. Promising second generation seedlings were chosen as parents to produce third generation seedlings. Due to limited space to plant seedlings only 5 crosses were made this year. Seedlings from 2011 crosses are currently growing in the greenhouse and will be planted in the field in September. Evaluations of all plants included bush size and growth habit, bloom dates and estimated amount of flowers, berry characteristics including BRIX analyses, and yield of each bush. Last September-October 534 plants of 18 promising selections were distributed to 19 grower-cooperators for trial and evaluation. Grower evaluations are very important for identifying the most successful selections. In Spring, 2012, over 900 plants of 19 selections were propagated for distribution in September 2012. Additionally, 12 newly identified promising seedlings were propagated for my own further evaluations. Each generation of seedlings reveals more about the nature of inheritance of traits which leads to superior choice of parents and consequently improved seedling populations. Cold storage tests of berries of 250 selections showed positive results. A few firmer-fruited types held up very well for 4 weeks in a refrigerator. Pollination tests of self-and cross-incompatibility among 14 selections were set up in vitro and flowers frozen for analyses with fluorescent microscopy when time permits.

Pest Management

Field scouting to assess treatment efficacy and monitoring protocols for the Spotted Wing Drosophila

Tom Peerbolt, PCM; Jana Lee, USDA ARS; Denny Bruck, USDA ARS formerly

The spotted wing drosophila (SWD) was first detected in the North American mainland and Europe in 2008-2010 and is a serious economic pest to stone and small fruits. To understand the phenology and habitat of they fly, we monitored for SWD for three years in various crop types from 63-72 fields. In 2010 and 2011, adult SWD did not begin to be trapped until mid-June, with rapid increases to high numbers toward the end of August. In 2012, flies were regularly detected early in the season and continued to be caught in rising numbers with a spike in August. To control the fly, we tested the efficacy of common insecticides. For conventional pesticides, Mustang Max provided ~14+ days of residual adult control followed by Malathion with ~7-10 days. Neonicotinoids do not seem to perform well against adult SWD. For organic pesticides, Entrust provided ~5-7 days of residual adult control whereas Pyganic provided no residual control but was a good contact poison for adult SWD. To quickly disseminate the information, we posted results via our web-based scouting system.

Native Habitat Restoration, Sustainable IPM and Beneficial Insect Conservation for Washington Viticulture

David James, WSU

Cooperators: Gwen-Alyn Hoheisel, WSU; Steven Link, WSU-Tri Cities; Robert Pyle, Xerces Society; & Vineyards/Wineries

Substantial progress was made in 2011 with the establishment of 8 commercial vineyard demonstration sites and commencement of regular monitoring of pest and beneficial arthropod populations. In general, trends for reduced pest abundance and increased beneficial insect diversity and abundance were seen in native habitat restored (NHR) or enhanced vineyards. In contrast, higher pest abundance and reduced diversity and abundance of beneficial arthropods were observed in 'conventional' vineyards with reduced native habitat. Diversity and abundance of butterflies was also greater in NHR vineyards. One hundred and six species of flowering perennial plants were evaluated for beneficial insect attraction and initial results are presented.

Biological and Chemical Alternatives to Broadcast Fumigation for Raspberry

Thomas Walters, WSU-Mount Vernon, NWREC & Inga Zasada, USDA-ARS-HCRL

Cooperators: Nik Grünwald, USDA ARS

We are developing short and long-term alternatives to broadcast fumigation for raspberry growers. In our first year, we developed an improved PCR assay for *Phytophthora rubi*, evaluated solarization and brassicaceous seed meals, and established five grower trials comparing bed fumigation with broadcast fumigation. In our second year, we evaluated plant growth by measuring cane length in the trials. We also evaluated *Pratylenchus penetrans* (root lesion nematode) population densities in fall and spring, and measured Phytophthora disease pressure in these trials with a greenhouse bioassay. We found that thus far, plants in bed-fumigated plots grew as much or more than their counterparts in broadcast-fumigated plots. We also found that bed fumigation has thus far provided equivalent or superior disease and nematode control compared with broadcast fumigation. We have cooperated with a custom fumigator in establishing their own bed fumigation trials, held a fumigation field day for growers, and presented research results at grower meetings and at national meetings.

Production / Physiology

Irrigation Guidelines for Sprinkler Frost Protection in Cranberry

David Bryla, USDA-ARS & Linda White, OSU

Cooperators: Knute Anderssen, Bob Donaldson, David Kranick, & Kim Patten

Sprinkler irrigation is required for frost protection of cranberry and is arguably the most important cultural practice used in production of the crop. Growers struggle however with questions on what temperatures to begin sprinkler frost protection, how much water is needed, and at what stages of development are the plants most susceptible to frost. If applied too early or too often, irrigation water may run out. When missed or applied too late, crop damage will result. A study was initiated in a commercial bed of 'Stevens' cranberry located in Langlois, OR. The objectives are to identify temperature thresholds to freeze damage and to determine the amount of sprinkler water required to protect the plants from frost. Temperature-control units were developed to expose the cranberry vines to freezing temperatures at various stages of plant development under field conditions, and a grid of thermo-couples was installed to monitor temperature within the bed. Ambient temperatures within the bed were similar inside and on top of the crop canopy (approximately 7.5 and 15 cm above the soil surface) but as much as to 2.4 °C

warmer at 15 and 30 cm above the canopy surface. Ambient temperature on top of the canopy was also as much as 1.1 °C warmer than cranberry leaf temperature at the same location. Temperatures thus varied with both height and location in the bed, illustrating the importance of thermocouple position when setting up a frost alarm. The temperature data will be used next to evaluate frost prediction models for cranberry. The temperature-control units were tested at -12 °C on 9 June 2011. Bed temperature was maintained near the set temperature but fluctuated as the freezer motor cycled on and off. Plants were also frosted following the test and died within a few days. The units were modified and tested again at -5 °C on 15 Nov. 2011. Chamber temperature varied <1.5 °C during the second test and the plants all survived following the test. The units were used in spring 2012 to expose different patches of plants within the bed to a range of temperatures above and below ambient. Tests were run during frost events whenever possible. Evaluation of the plants following each test is on-going and will be completed this fall.

Developing a Site Selection Tool Using GIS and Grapes as a Model System

Joan Davenport, WSU; Gregory Jones, SOU; & Andrew Duff

Cooperators: Michelle Moyer, WSU & Ian Yau, WSU

Using a the computer Geographic Information System Tool ArcGIS & publically available data, we compiled 30 year weather data, soils data, & topographic data for the inland Pacific Northwest. Once this extensive data base was compiled, we developed a model based on key production factors for site suitability for growing both wine & juice grapes. The model ranks sites for low to high likelihood of success based on cultivar heat requirement. Working with growers in central Washington, we compared our ranking with the growers perception of the field and found that the correlation was acceptable. Further efforts to "ground truth" the model against other sites in a broader geographic range.

A Link Between Grapevine Bleeding and Budbreak, Shoot Growth, and Fruit Set: Causes and Consequences for Vineyard Management

Markus Keller, WSU

Cooperators: Bhaskar Bondada, WSU

There is reason to believe that the stunted shoot growth and poor fruit set observed in unirrigated inland Northwest vineyards after the dry winter of 2004/05 (23-45% of normal precipitation) may have been caused by the vines' inability to initiate sufficient sap flow ('bleeding') before budbreak. This may have led to failure of their hydraulic system, leading to inadequate water supply to the developing canopy. We began investigating these questions in the spring of 2011 and continued in 2012, using pot experiments designed to vary soil moisture before and during budbreak. The resulting differences in budbreak and grapevine vigor were assessed by measuring shoot length. Bleeding sap was collected to determine whether spring shoot vigor is related to the bleeding rate and/or content. All data collected to date point to the existence of a soil moisture threshold below which bleeding cannot be initiated by grapevine roots. This appears to be associated with an inability of buds to break. Under severe drought stress, vines died. But under moderate stress, budbreak was possible albeit followed by stunted shoot growth and abortion of clusters. Shoot vigor and canopy development increased with increasing soil moisture.

Small Fruit Initiative

Small Fruit Breeding for the Pacific NW at Washington State University Puyallup

Patrick Moore, WSU & Wendy Hoashi-Erhardt, WSU

This project will develop new red raspberry cultivars adapted to the PNW that are machine harvestable and suitable for processing. Important traits like resistance to raspberry bushy dwarf virus (RBDV) and tolerance to root rot are also being pursued for new raspberry cultivars. The project will also develop new strawberry cultivars adapted to the PNW and that have higher picking efficiency than current industry standards. Additional aims for new strawberry cultivars are fruit firmness and disease resistance.

Raspberry Breeding

Once raspberry seedlings are selected, they are then planted in small plots with a cooperating grower and evaluated for machine harvestability. Selections that appear to machine harvest well are tested for yield, fruit size, and fruit firmness in replicated trials at WSU Puyallup, and also evaluated for susceptibility to root rot and raspberry bushy dwarf virus. Selections possessing several promising traits are propagated into quantities suitable for grower trials. In 2015, a new machine harvesting planting was established with 35 WSU selections, 18 BC selections and the cultivars 'Cascade Harvest', 'Meeker' and 'Willamette' for reference. This planting will be machine harvested and evaluated in 2017 and 2018. The 2012 planting was evaluated for the second season and the 2013 planting evaluated for the first time in 2015. Promising selections in each planting will be identified and propagated for further testing. In 2015, 51 preliminary selections have been made among the raspberry seedlings planted at WSU Puyallup in 2013. Additional observations of root rot susceptibility/resistance among advanced selections have led to the identification of some selections that are machine harvestable and root rot resistant.

Strawberry Breeding

Ongoing strawberry breeding work is focusing on parents with large fruit size, firm fruit and high productivity. Forty selections were made in 2015 among the strawberry seedlings planted in 2014. These selections will be propagated for planting in yield plots in 2016. The selection trials planted in 2013 and 2014 were harvested in 2015. Selections with promise will be propagated and planted in a new selection trial for additional evaluation.

Evaluation of Small Fruit Germplasm at the NWREC-OSU

Bernadine Strik, OSU & Chad Finn, USDA-ARS

All aspects of a breeding program are being conducted including parental selection, crossing, selection and testing for strawberry, blackberry, raspberry and blueberry. Recently under this project, 11 new strawberry cultivars (Independence, Firecracker, Tillamook, Pinnacle, Valley Red, Sweet Bliss, Puget Crimson, Puget Summer, Stolo, Sweet Sunrise, and Charm), six genetically thornless blackberries (Black Diamond, Black Pearl, Nightfall, Wild Treasure, Columbia Star, Columbia Giant), seven trailing blackberries, especially suited to the fresh market (Siskiyou, Black Butte, Obsidian, Metolius, Newberry and Onyx), two thorny erect primocane fruiting blackberries (Prime-Jan, Prime-Jim), three primocane-fruiting raspberries (Chinook, Vintage, and ORUS 4090-1), seven summer-bearing red raspberries (Coho, Lewis, Esquimalt, Cascade Bounty, Cascade Harvest, Cascade Gold, and Saanich), and four blueberries (Chandler, Pink Lemonade, Perpetua, Baby Blues) have been developed and released. The first patented cultivar from this program was 'Onyx' in December 2011 and patents have been filed for all releases since then. Several of these recently released cultivars have been tremendous successes and have become widely planted especially 'Black Diamond', 'Columbia Star' and 'Obsidian blackberries and 'Tillamook' strawberries. While the strawberry cultivars will be grown primarily in the PNW, the raspberry, blackberry, and blueberry cultivars are grown in many other production regions in North America and the world. Appropriate cultural practices for optimum yield and quality of advanced selections and new cultivars have been researched and established. The mean estimated impact of recently released cultivars released since 2001 in this program was about $19.9 million for the PNW

including fruit sales and plant nursery sales. This annual impact increases to $45.3 million when including cultivars we co-developed with other breeding programs and to $59.0 million when including all cultivars released from this cooperative program (including those prior to Finn and Strik).

Quality Evaluation of Berry Selections and Varieties

Brian Yorgey, OSU & Yanyun Zhao, OSU

Cooperators: Chad Finn, USDA-ARS; Pat Moore, WSU; & Michael Dossett, Agri-Food Canada

Our part in this group effort to bring new berry varieties to the growers, processors and consumers of the Northwest is focused on fruit quality evaluation of standard cultivars and new breeding selections. Berries from the breeding plots at the North Willamette Research and Extension Center were picked weekly from late May through early September, 2014, and brought to the OSU Food Science Department in Corvallis for processing and evaluation. Basic chemical data were collected on strawberries, blackberries, red raspberries, black raspberries, and blueberries for multiple harvest dates throughout this period. Samples were frozen and displayed to industry representatives and researchers during the fall, winter and early spring. This information will be used with field data to select the berries which will be included in further breeding trials.

Wine Processing

Detection and Quality Impact of *Zygosaccharomyces* in Wines

C.G. Edwards, WSU

Cooperators: C.F. Rossand J. Zuehlke, Ph.D. Graduate Student

Non-spoilage strains of *Zygosaccharomyces* are being evaluated that could potentially utilize residual sugars from wines where alcoholic fermentation prematurely ceased. Ethanol tolerances of the *Zygosaccharomyces* isolates were similar tothose of *Saccharomyces* (limited growth >15.5% v/v).A red wine was adjusted to different amounts of ethanol (13 to 17%) and fructose (20 to 60 g/l) prior to inoculation with one of three strains of *Zygosaccharomyces*. None of the strains entered logarithmic growth and although some fructose was metabolized, dryness (<2 g/l) was not always reached. Only in the low ethanol (13%) and high fructose (60 g/l) condition did *Z. bailii* W3 bring the wine to dryness faster than *S. cerevisiae* EC1118. While culturability of *Zygosaccharomyces* in wine was not necessarily affected by SO_2 nor low temperature, the yeast was sensitive to the anti-fungal agent Velcorin®. Data suggests that this species may exist in a "viable-but-not-culturable" state but additional evidence is required.

NCSFR Research Priorities for 2017-2018

The Priority Setting Sessions are held at the annual conference where priorities are reviewed and revised by commodity groups. Commodity organizations review their priorities in their research committees prior to the annual conference, and come prepared for discussion. Industry members participate in and make decisions in these sessions with assistance from scientists as requested. The NCSFR priorities are referenced by scientists when they submit research proposals and are utilized by the peer review panels during evaluation of the proposals.

Northwest Center for Small Fruits Research

Grape (Table) Viticulture Research Priorities
for 2017-2018 funding
Revised November 2012

1A)	Evaluation of varieties to increase berry and cluster quality.
B)	Study canopy design to maximize berry quality and yield at harvest and after storage.
C)	Study of impact of varieties and canopy design on fruit set and yield components.
D)	Nutritional management for different varieties and canopies.
E)	Variety and canopy effects on water management.
2A)	Photosynthesis and carbon positioning under different canopy systems and varieties.
B)	Disease resistance in different vine architectural systems.
C)	Density of canopy affecting insect populations.
D)	Comparison of flavor components in different regions.
E)	Studying culture of galls in table grapes.
3A)	Develop web tools for sustainable site development.
B)	Evaluation of rootstock on cultivar vigor.
C)	Rootstock effect on canopy volume and nutrition.
D)	Effect of nematodes on vine growth.
E)	Effect of rootstock on scion, berry quality and yield.

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Grape (Wine & Juice) Viticulture Research Priorities
for 2017-2018 funding
Revised November 2012

1A)	Water management to optimize grape and wine flavors.
B)	Incidence, impact, vectors and management of grape vine viruses.
C)	Nutrient management for optimizing plant health and wine quality.
D)	Biology and management of fungal pathogens: Powdery mildew, Botrytis, Sulfur management and its impact on wine quality
E)	Grapevine physiological disorders that affect yield and quality: short shoot syndrome (SSS), berry shrivel
2A)	Biology and management of pests: brown marmorated stink bug (BMSB), light brown apple moth (LBAM) mites, leafhoppers, nematodes.
B)	Development and evaluation of alternative/stainable production systems.
C)	Grapevine hormonal response to cultural practices.
D)	Development of physiological or biological indices (biomarkers) that can be used to gauge the effects of viticultural practices on fruit ripening and determine when peak ripening occurs.
E)	Yield modeling and estimation.
3A)	Optimizing cluster architecture.
B)	Climate change as it pertains to grape production.
C)	Evaluation of scions and Rootstocks for the PNW.
D)	Development of web based research data accumulation tool in order to provide variety and site suitability for grape and wine production in the PNW.

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Wine Processing Research Priorities
for 2017-2018 funding
Revised November 2012

1A)	Methods of measuring grape and wine phenolics and their precursors to impact wine color and flavor. Identification of aroma and flavor compounds and their individual and combined impact on wine quality.
B)	Yeast nutrient status of PNW wines.
C)	Preventing sulfide and other reduction compounds.
D)	Interaction of native and inoculated yeast and bacteria – managing native and inoculated fermentations.
E)	Incidence and control of Brettanomyces, Pediococcus and Lactobacillus
2A)	Managing stuck and sluggish fermentations.
B)	Incidence of biogenic amines in PNW wines.
C)	Effect of Botrytis and laccase on wine quality
D)	Methods of organic wine production.
E)	Environmental Taint (i.e. smoke, feed lot)
3A)	Utilization of value added products.
B)	Alternate methods of heat stability
C)	Pre-fermentation fruit handling.
D)	Supporting research on the impact of viticultural practices on grape and wine quality.
E)	Processing technology e.g. high pressure filtration, alternate methods for wine sterilization.

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Blueberry Research Priorities
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1A)	Plant breeding/varietal evaluation
B)	Management of Botrytis
C)	Biology and management of Spotted Wing Drosophila
D)	Organic production systems
E)	Research of mechanical harvesters of fresh market fruits
2A)	Biology and management of pseudomonas
B)	Vertebrate management
C)	Fertility management
D)	Management/irrigation/chemigation, cooling, fertigation, water delivery, frost protection
E)	Food safety
3A)	Biology and management of arthropod pests including garden symphylan, root weevil, gall midge, winter moth, wireworms
B)	Biology and management of diseases (especially root rot, and mummy berry) and virus complex
C)	Methods to reduce cost of labor (i.e., mechanical harvester, pruner, weed mat, etc.)
D)	Improve or extend fresh market, controlled atmosphere packaging, physical covers or chemicals, post-harvest handling and cultural inputs
E)	Pollination

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Cranberry Research Priorities
for 2017-2018 funding
Revised November 2012

1A)	New herbicides for control of priority perennial weeds.
B)	Soil borne pest control (cranberry girdler and root weevil)
C)	Alternatives to organophosphates for cranberry insect control which are effective with chemigation
D)	Production systems for new planting and renovations, including new varieties and nutrient management
E)	Irrigation system to optimize frost protection and pesticide applications
2A)	Pollination and fruit set
B)	Sanding systems and alternatives for new and established plantings
C)	Systems for fresh fruit production and quality
D)	Vertebrate pest management
E)	Evaluate wireless frost alert and soil moisture units for use on cranberry farms
3A)	Market expansion through nutraceuticals/health or sustainable practices
B)	Tipworm
C)	Yellow vine and other causes of dieback

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Strawberry Research Priorities
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1A)	Alternate production systems for economic efficiency, increased yield and cultivar management, including reducing harvest costs.
B)	Accelerate the introduction and commercialization of promising selections (grower trials)
C)	Develop cultivars with processed and fresh market potential, including earlier and later ripening
D)	Weed control
E)	Biology and management of botrytis
2A)	Biology and management of Spotted Wing Drosophila
B)	Biology and management of root weevil
C)	Nutritional and nutraceutical benefits
D)	Soil Fumigation
E)	Irrigation management
3A)	Mite management
B)	Post harvest management of fruit
C)	Vertebrate pest management
D)	Food safety/sanitation/security
E)	Value added products

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Blackberry Research Priorities
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1A)	Management and biology of Spotted Wing Drosophila.
B)	Evaluate new insecticides/management strategies.
C)	Breed cultivars that are thornless, high-yielding, winter hardy, machine harvestable, disease resistant, and have superior fruit quality.
D)	Control/management of most challenging perennial weeds including Canada Thistles.
E)	Development of micronutrient sufficiency-management programs.
2A)	Biology and control of Botrytis.
B)	Development of organic production systems.
C)	Improving the viability of fresh market production.
D)	Cold hardiness.
E)	Primocane management.
3A)	Biology and management of emerging pests.
B)	Interactions of soil borne pathogens.
C)	Improving labor efficiency (lowering costs and/or increasing outputs).
D)	Water management.
E)	Virus Management.

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Red/Black Raspberry Research Priorities
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1A)	Develop cultivars that are summer-bearing, high-yielding, winter hardy, machine-harvestable, disease resistant, virus resistant and have superior fresh and processed fruit quality.
B)	Understanding soil ecology and soil-borne pathogens and their effects on plant health and crop yield.
C)	Fruit rot, including pre-harvest, post-harvest and for shelf-life.
D)	Soil fumigation techniques and alternatives to control soil pathogens, nematodes, and weeds.
E)	Evaluation of the life cycle and management options of the Spotted Wing Drosophila.
2A)	Harvest contaminants and problems stemming from the loss of longstanding insecticides.
B)	Weed management.
C)	Nutrient/Irrigation management.
D)	Viruses/crumbly fruit.
E)	Mite management.
3A)	Vertebrate pest management.
B)	Product and Production Certification Systems - food safety & security, standards, traceability.
C)	Season extension: improve viability of fresh marketing.
D)	Labor saving cultural practices including mechanical pruning and tying techniques.
E)	Foliar & Cane Diseases – i.e. spur blight, yellow rust, cane blight, etc.

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New Specialty Crops Research Priorities
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Lonicera, Bilberry, Schisandra chinensis Baill, Gooseberry, Currants, Hardy Kiwifruit, Lingonberry, Huckleberry, Chokeberry (Aronia melanocarpa), Elderberry, Sea Buckthorn Berry (Hippophae), Buffalo Berry (Shepherdia), Gogi Berry

1A)	Pesticide tracking, registration and re-registration issues for new up-and-coming crops
B)	Cultivar Development: Germplasm collection, improvement, evaluation, and introduction
C)	Develop and/or improve a production system (how do we grow these crops?)
D)	New product development/marketing: including nutraceuticals
E)	Nutrition of new crops(fertilization)
2A)	Foliar diseases in Ribes
B)	Fresh market storage
C)	Quality of new fruit crops
D)	Pollination/fruit set
E)	Frost Protection of Hardy Kiwifruit
3A)	Investigation of mycorrhizal associations in Huckleberry
B)	Currant fruit fly (also called gooseberry maggot)
C)	Phytophthora in Hardy Kiwifruit

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